

**MANUAL OF
OPHTHALMIC
OPERATIONS**

F. P. MAYNARD

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LIEUTENANT-COLONEL F. P. MAYNARD of Calcutta, who is one of the best known ophthalmic surgeons in India, has written a *Manual of Ophthalmic Operations*⁶ which is a most practical work. The first three chapters deal with the preparation of the surgeon, patient, instruments, lotions, operating room, etc., and contain a discussion of the advantages and disadvantages of the various local anaesthetics. In speaking of the risks of chloroform anaesthesia, it is said that they are very remote, owing to the fact that most operations in India are practically performed out of doors; and in any case with very free access of air, "unlike the condition prevailing in many of the European operation theatres, which are sometimes the subject of comment among surgeons from India visiting them." In addition, by following the teaching of Lawrie the greatest attention is directed to the respiration. In dealing with the general principles of intraocular operations, Colonel Maynard makes some of the most practical and common-sense remarks we have ever seen in any book, remarks which should encourage the nervous beginner, thus:

Though a steady hand is a valuable possession in ophthalmic surgery, it is not an absolute necessity. Moreover, steadiness must not be confused with rigidity. Suppleness and a readiness to adapt oneself immediately to unforeseen conditions is preferable to steadiness *per se*.

Some of the worst eye operators ever seen have been those heavy, stolid surgeons whose hands are like a rock for steadiness, and who are quite incapable of adapting them to the delicate adjustments necessary in ophthalmic surgery. All the illustrations in the book are drawn as the patient appears to the surgeon when he is standing at the head of the table, and not as the spectator sees him; thus, at first sight one is apt to think that an iridectomy or an extraction, which is really being done upwards, is being performed in the lower segment of the cornea, but this is at once explained in the text, and the appearance is only due to the fact that the illustrations in almost all books are figured from the point of view of the spectator, and not that of the operator. Besides the ordinary operation for glaucoma, a very detailed account of Herbert's operation is given. As regards extraction, the author is very decidedly in favour of combining it with an iridectomy. There are several stereoscopic pictures illustrating the various stages of the removal of the lens. Then follows a most useful chapter on accidents and complications during and after the operation. Chapter VII deals with the expression of the lens in the capsule by Smith's method, which the author does not favour, and also the subconjunctival extraction of Czermak. Operations on the conjunctiva and cornea are next described, followed by lid operations and the treatment of trachoma and its complications, and after that comes operations on the lacrymal sac, together with the details for its extirpation, and the various operations for excision of the eyeball. Finally, there is an account of Worth's operation for advancement. No one who reads this volume can fail to realize the vast experience of the author. The book is full of little points which are only to be found out by long practice, and which are usually conspicuous by their absence in textbooks. The book could be greatly enlarged, but the author has evidently confined himself to describing the operations he most believes in. Any one wishing to supplement his practice by the rich experience of such a surgeon as Colonel Maynard could not do better than study this volume.

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OF
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MANUAL
OF
OPHTHALMIC OPERATIONS

BY

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SIX STEREOSCOPIC PLATES AND 104 ILLUSTRATIONS.

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δῆλον ὅτι δεῖ τὸν πολιτικὸν εἰδέναι πως τὰ περὶ ψυχὴν
ὥσπερ καὶ τὸν ὀφθαλμοὺς θεραπεύοντα καὶ πᾶν σῶμα...

Aristotle, Nic. Eth. I, xiii.

PREFACE.

MOST of the operations are arranged under the headings ‘indications,’ ‘instruments,’ ‘anæsthesia,’ ‘method,’ ‘accidents,’ ‘after-treatment.’ This renders the book of more use to house-surgeons and others whose duty it may be to prepare patients for operation and to take care of them afterwards.

I have to thank Sir Henry Swanzy for permission to reproduce figs. 58, 70, 71, 72, 75, 77, 78, 79 and 89, Professor Fuchs for figs. 67 and 76, Professor Kuhnt for figs. 63, 64 and 65, and Drs. May and Worth for fig. 104, taken from their well-known works ; and Captain Megaw, I.M.S., for assistance in the taking of the stereoscopic plates.

13, HARINGTON STREET.

F. P. MAYNARD.

CALCUTTA ;

February 1908.

NOTE.

A dismantled stereoscope is required. The book should be placed open with the plate facing one, about ten inches distant. Three images will be seen. The end ones are disregarded, and the central one, composed of two overlapping, is focussed carefully, tilting either end of the plate if necessary, until the proper stereoscopic effect is produced.

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ERRATUM.

Page 174. Fig. 82. For *caniculus* read *canaliculus*.

MANUAL OF OPHTHALMIC OPERATIONS.

CHAPTER I.

PREPARATION OF THE PATIENT, SURGEON AND ASSISTANTS.

The Patient.

GENERAL.

IN the more important eye operations, and in all those where general anæsthesia is required, a careful general examination of the patient is necessary. The condition of the main organs, heart, liver, spleen, kidneys, and especially lungs, should be ascertained. Diseases of the lungs, such as bronchitis, phthisis, bronchiectasis and asthma are particularly undesirable complications, partly because the sputum may prove a source of infection, and partly because the paroxysms of coughing cause a severe strain upon the wound in the globe, and may burst it open if occurring before it is united, or they may delay its healing, besides not infrequently causing hæmorrhage with more or less disastrous results. Otherwise disease of the lungs, albuminuria, and diabetes, in their early stages at any rate, do not appear to interfere with the natural healing of wounds of the eye-ball. Gonorrhœa and active syphilis tend to complicate the healing of wounds by predisposing to iritis. The mental condition of the patient is important. Lunatics, of course, make bad

patients, like animals. Yet the author has operated upon several for cataract with success and with distinct benefit to their insanity. By choosing a quiet time, humouring their peculiarities and gaining their confidence, much may be done. General anæsthesia may be necessary in them, but it is better dispensed with if possible, as excitement may follow it and bandages may be torn off, etc. It is advisable to bandage one eye only as the lunatic is more likely to leave it alone then. Apart from actual insanity, many patients exhibit mental traits that are trying to the surgeon. The too willing is as difficult to manage and anticipate as the too phlegmatic patient, but the latter does better as a rule. Women make worse eye patients than men, unlike our experience of them in general surgery. Their curiosity and restlessness are greater and lead them into trouble, so that auto-infection is commoner in women—among Indians at any rate. Deafness complicates matters and may lead to unexpected movements and disasters during operation. Diseases of the ear, nose and throat are important, and should be excluded, or recognized and provided against, or cured before the eye operation is undertaken. Death has occurred after cataract extraction, where there were nasal polypi shutting pus up in the upper meatus. General septicæmia followed and death. Short of this, the eye may become infected from disease in the nose, and some surgeons go so far as to spray the nares of all patients requiring corneal section, either by a mixture of Listerin, and Dobell's solution, or with equal parts of water and peroxide of hydrogen (de Schweinitz).

It is unnecessary, except for æsthetic reasons, for patients to have baths before ophthalmic operations. Gifford,* whose commonsense in dealing with the essentials

* *Jour. of Amer. Med. Assoc.*, Oct. 3, 1903.

and non-essentials of ophthalmic asepsis is commendable, says of the proposal: "It seems to me that for an eye surgeon to have his patients take a full bath with any idea that he will on that account get better results from his operations, is on a par with the logic of the medicine man who beats a tom-tom to drive out the spirit of disease."

As regards season, patients in India generally settle the question for themselves by choosing the cold season and avoiding the hot and rainy seasons. Operations during the latter part of the rains (the malarial fever season) are not so successful as at other times, probably because at that time the general health is at its worst.

LOCAL.

General Remarks.—The problem of local preparation for operation elsewhere in the body is comparatively simple. The incision is made through skin or mucosa that can be well sterilized, and, nothing septic being brought into contact with the wound, primary union is a certainty. We can make certain that one brings nothing septic into contact with wounds made into the eye-ball through ourselves, our instruments, lotions or dressings, but the first essential—perfect sterilization of the field of operation—we cannot obtain. Bacteriological examination has taught us that the healthy conjunctival sac always contains micro-organisms, frequently pathogenic, and that these are found chiefly along the edges of the lids and in the fornices. If the conjunctiva is not healthy, and particularly if the lacrymal sac is not healthy, these organisms are enormously increased and the chances of infection of wounds is proportionately greater. The growth of organisms is also promoted by the application of

bandages, and of all means of ensuring a plentiful supply of bacteria on the morning of an operation, the custom of applying a 'test dressing' the night before is the surest. Numerous experiments have shown that the complete removal of germs from the conjunctival sac—its sterilization, that is—is an impossibility, whatever method of attempting it be adopted. In other words, an aseptic operation on the eye cannot be done. This is due partly to the fact that chemical solutions to have any real germ-killing power must be of a strength that damages the cornea and severely irritates the conjunctiva. We know that a 1 in 1000 sublimate solution does not kill pus cocci after ten minutes contact. Yet a 1 in 2000 solution cannot with safety be applied to the eye for more than a few seconds. Even then if it is not washed out with sterile water or normal saline solution, there is a danger of some of it entering the anterior chamber, if that is opened, and causing some opacity of the cornea which is permanent. The other reason for aseptic operations being impossible is that the areas where infection may lurk are so extensive and hidden. The roots of the eyelashes, the transitional folds of the fornices and the extensive lacrymal passages may and do all harbour organisms, and are all difficult, if not impossible, to disinfect.

If aseptic operations are impossible, however, experience shows that the infections may be very much reduced by appropriate local preparation. Practically we find that the treatment of the lids, conjunctival sac, and lacrymal passages by such antiseptics as can be used does, as a matter of fact, reduce the number of organisms and inhibit the power of the remainder to such an extent that septic infection of the wound becomes a rarity.

Whereas fifty years ago a loss of half the eyes operated upon for cataract—mostly from sepsis—was regarded with complacency if not satisfaction, now a loss of more than one per cent. from that cause is regarded as preventible. This enormous improvement is due in part no doubt to better devised operations and more rational technique, but the application of Listerian principles to the preparation and after-treatment of the patient's eye has had a great deal to do with it and should receive its due share of the credit.

The directions here given for the preparation of the field of operation recognize the importance of carrying it out as thoroughly as possible. At the same time, they realize the limitations there are, arising from the delicate nature of the structures involved.

The *skin* of the patient's face, forehead and eyelids is scrubbed with soap and water, and then with mercuric iodide* lotion (1 in 5000), the eyelashes are cut short the day before operation, and the washing is repeated on the morning of operation. It is easier to clean the roots of the lashes after cutting them, and they do not get matted together with secretion after operation. If not cut, they are apt to blunt the knife in a cataract operation.

Epilation is not only unnecessary and painful, but actually injurious, as in the reaction which follows, the organisms present around the roots increase rapidly and infection is more likely to occur.

During operation a towel or small sheet that has been boiled for half an hour is placed over the face. It has a hole cut in it exposing the area of operation.

* For calculation of strength of mercuric iodide lotion see p. 19.

The *conjunctival sac* requires careful preparation. As already stated, when apparently healthy, it contains numerous organisms, some of which may be pathogenic. If pneumococci, gonococci, Week's bacilli, or staphylo- or strepto-cocci are found, operation is excluded. The amount and character of any discharge present furnish no guide to the organism causing it unfortunately; organisms may be present too without any discharge. Bacteriological examination does not always reveal their presence, as it is practically impossible to take cultures from all parts of the area, and the bacteria present may be missed. So that, valuable as a positive result would be, a negative bacteriological examination does not mean safety, and the sac must be prepared just the same. If there is time, a "test-dressing" may be applied, *at least two* clear days before operation, to test if there is any abnormal secretion of mucus. The application of such a dressing always increases the growth of organisms in the sac and the secretion of mucus. If the latter is excessive, a few days' treatment with nitrate of silver (half per cent. solution) or argyrol solution (3i to 3i) should be carried out. If the mucus is not excessive—it is manifestly a matter of opinion, of experience, and difficult to define, what is excessive—the two days remaining before operation suffice for the extra secretion set up by the bandage to subside. There has been much discussion as to the best lotion to use in preparing the sac. Major Herbert of Bombay uses perchloride solution 1 in 3000, and regards the free secretion of mucus with shedding of the superficial epithelium (conjunctival) caused by it as a ready means of removal of the organisms which are washed away in the mucus. Even he, however, says that the effect varies nearly as

much with the quantity of lotion used as with its strength. Many surgeons use mercurial solutions of much weaker strength, and some use normal saline solution only with good results, trusting to the mechanical effect of scrubbing the conjunctiva with it. The explanation probably is, that when pathogenic organisms are not present, all cleansing lotions are superfluous ; when they are, they can be got rid of by sufficiently vigorous cleansing with almost any sterile or weakly antiseptic lotion. As, however, many of the conjunctival sacs we have to operate on are not healthy, and it is proved that in a long series of operations infections are less often met with when antiseptic lotions have been used—whether they remove the organisms mechanically or inhibit their action does not matter—it is certain that we ought to use them. In the author's clinic mercuric iodide of mercury lotion 1 in 5000 is used for cleaning the sac. It is irrigated with the lotion, and wiped out with swabs dipped in it, the day before, and again on the morning of operation, the eye being left without any dressing between-whiles.

The *lacrymal passages* are to be most carefully examined. Pressure over the sac may cause regurgitation, through the canaliculi, or may force secretion on into the nose, when it is not healthy. The passages may be infective, however, without its being revealed in this way, and there is no doubt that it is safer to syringe some saline solution through into the nose and make the patient blow the nose on to a vulcanite tray. Any secretion washed through can then be seen and examined, and if disease be present, the passages should be syringed through for some days with argyrol solution (five or ten per cent.) or weak mercuric iodide solution (1 in 10000).

If there be a stricture and blenorrhœa, nothing short of extirpation of the lacrymal sac will suffice before performing an operation, such as cataract, in which the globe is opened. Sealing the puncta with the galvano-cautery or ligaturing the canaliculi with temporary ligatures has been recommended. In any case the inner canthus is to be filled with clean iodoform after the operation on the globe.

The three main sources of danger lie in the fornices, the edges of the lids and the lacrymal passages, and too much care cannot be expended in seeing that these are in a healthy condition before operation is undertaken.

Should diseases, such as hordeolum, chalazion, or trachoma be present, they should be treated before operation. In a case of *trachoma* complicating cataract, if not severe and without complications, proper treatment will render it safe to operate within a short time. Where more severe and chronic, prolonged treatment will be necessary and even with it the result is apt to be unsatisfactory. Where sequelæ of trachoma exist, such as pannus, leukoma, etc., the result, even if the eye escape infection, is often not good as regards vision. A complete peritomy may be advisable, but even if it is not, it is as well to remember that the incision acts like a localized peritomy, and that an iridectomy is desirable as it will give the best vision possible by being situated behind what will, as a result of the incision, become the clearest part of the cornea.

Surgeon and Assistants.

The elaborate preparations adopted in general surgery are not necessary in ophthalmic operations. Even the surgeons' hands rarely touch the wound directly and need never do so in most operations. They handle the

instruments, however, and so should be made and kept clean. Surgical millinery, such as chef's caps, linen overalls, rubber gloves and shoes are not required. Masks, however, are of value, unless the operator can be silent and ensure others being so. The danger of salivary infection is very real and may explain many otherwise inexplicable cases of infection. Experiments show that during ordinary quiet conversation particles of saliva infected with bacteria are ejected to a considerable distance. When culture plates are held in front of the speaker, they become more thoroughly infected, the nearer they are brought to the mouth. Raising the voice infects them at a greater distance. In eye operations the field of operation is 'in the line of fire' and at short range—twelve or fifteen inches only—so that infection is probable unless the operator keeps silence or wears a mask. The author prefers to keep silent, and makes the house-surgeon direct the patient, if that is required, looking away from him while doing so. If a mask is worn, a double fold of fine gauze or muslin is enough, and it may either be fixed on a spectacle-frame or applied like a bandage.

The hands, with nails kept short, are scrubbed with soap and water and then with either carbolic lotion 1 in 80 (this rather deadens sensibility, if many operations are done) or mercuric iodide lotion 1 in 2000 (this tends to discolour the nails in time). This process is repeated between each operation. The coat is removed and shirt sleeves rolled up. In operations that may be bloody, such as Krönléin's, a sterilized white overall is required. The assistants, including the nurse, adopt the same measures.

CHAPTER II.

OPERATION ROOM—INSTRUMENTS—DRESSINGS— LOTIONS. ETC.

Operation Room.

IN a hospital all the conditions of the modern operation theatre are desirable, marble floor, tiled walls, rounded corners, absence of ledges and other dust-collecting projections. A plentiful supply of pure water and facilities for washing the hands are necessary. If there is no pedal arrangement for turning on the water with the foot, some one should turn the water on and off for the surgeon. No plugs are needed in the basins as the hands should always be washed in running water. Needless to say, septic cases should not be operated upon with the same instruments, however good the sterilizing arrangements are. Such cases are better operated upon in a separate room, with everything required, including dressings, kept separate, or accidents will happen sooner or later. The operation table is easier to clean and looks nicer if made of metal and glass. It should measure about 6' × 2' 6", and be provided with two pillows covered with white macintosh, 3"–4" thick. The patient should lie at such a level that in operating the surgeon's forearms are horizontal or with the hands a little higher than the elbows. Before the patient lies down, a piece of strong canvas as large as the table, folded over and strongly sewn along each side, is laid on the table, under a sheet, so that after operation poles may be passed along

the loops at the sides, and when ringed iron bars are applied at each end to the poles, the stretcher is complete and the patient is easily lifted and carried away to his bed, where the bars and poles are removed and the canvas slipped from under the patient (fig. 1). The light is important and should be indirect sunlight or electric. Daylight is



FIG. 1.—Canvas and bamboo stretcher, with ringed iron rods at head and foot, for removing patient from operation table to bed.

best obtained from a north aspect, and the patient had better be so placed that the reflexes from the windows fall upon that part of the cornea which is not to be operated upon. Electric light can only be made use of if the room can be darkened enough with roller blinds, and a special focussing lamp and an assistant to work it are necessary.

In a private house a room has to be chosen for its light usually. All hangings and superfluous furniture and matting or carpets should be cleared out at least two days beforehand, so as not to have dust flying about. The bed should be of a convenient height and have no headpiece, or if it has one, the patient must lie with his head to the foot where there is none. It is well to order a thin towel to be boiled for half an hour before one's arrival and kept warm in the vessel untouched, also to have ready one kettle of water boiling and another which has been boiled and allowed to cool in its kettle untouched. The towel can be wrung out and used on the patient's head, the cooled sterile water can be used for cooling down lotions, and the boiling water is available for making lotions and helps to make boiling of the instruments quicker. If these things are made ready at the patient's house, with basins, soap and plenty of water and some rectified spirit, the operator's time is saved and many useless delays avoided.

It is unnecessary to be able to completely darken *ophthalmic wards*. Painting the walls yellow or pale-green, and closing some of the *jhill-mills* (venetians) is enough. The provision of a plentiful water supply from taps over basins, and soap for washing the hands in each ward, has an appreciable effect in reducing infection and is a very desirable addition. — .

Instruments.

General Remarks:—The sharpness of cutting instruments is tested on thin kid tightly stretched over a small drum of ebony. A cataract knife or keratome should puncture the skin by its own weight. Priestley Smith has invented a convenient instrument for testing the

sharpness. Rust can be seen by the eye. After its removal, roughness of the surface can be detected by a lens or by stroking it with dry wool. Any bluntness or roughness of the surface renders a cataract knife unserviceable. Roughness is also objectionable on cystitomes and iris forceps, as the iris is caught by it and dragged along, so that the instrument does not pass smoothly into position.

The teeth of forceps should be examined with a lens when closed, to see that they close accurately. They easily get slightly bent, while being cleaned, so that the teeth do not interlock properly. Fixation forceps should have at least three teeth on one side and two on the other.

The shape and weight of the speculum are important, in cataract operations more especially. It should be strong enough to prevent bending and light enough not to press on the eye when hanging down. It should be so curved that the lid-opening portions do not press unequally upon the globe, and so that the hinge and fixing screw lie on the temple out of the way. Clark's and Foveaux's speculum meet these requirements the best. Those with closed-in solid blades tend to cause prolapse of vitreous, though they keep the lashes and lid margins protected from infecting. Curettes and spoons of various shapes are obtainable, but one can do all one's cataract work with Graefe's curette and cystitome, Bowman's double spoon, and Taylor's vectis.

Sterilization.—After operation, used instruments—cataract knives excepted—are scrubbed with soap and water by a brush, carefully dried and put away in the glass cabinet. When required for use, they are placed in the sterilizer in boiling two per cent. sodium carbonate.

solution and kept there for fifteen minutes (fig. 2). The sodium carbonate hinders though it does not prevent discolouration and rusting of the instruments, and removes anything greasy that may have escaped the previous cleansing process. It also raises the boiling point of the water and the sterilization is more complete than with

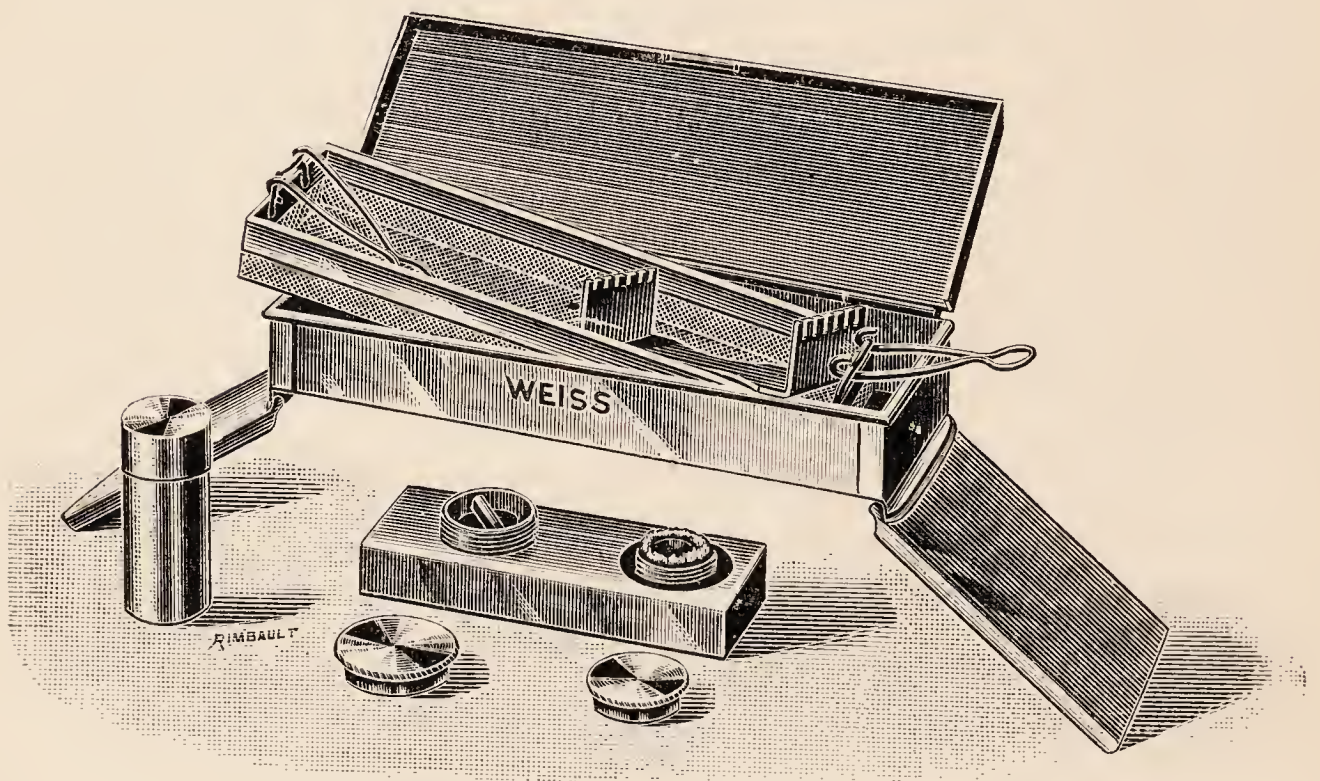


FIG. 2.—Portable Sterilizer.
When closed it measures, $7\frac{1}{2}'' \times 2\frac{1}{2}'' \times 1''$.

plain water. Sharp instruments are wrapped in cotton wool to prevent blunting from bumping against other instruments while boiling. The instruments are then removed by means of a sterilized pair of dressing forceps and placed in the order in which they will be used in a china or glass tray half filled with sterilized water. It is more convenient if it is provided with a raised rack for the instruments to rest on (fig. 3). The tray should have been carefully washed out first with strong carbolic lotion (1 in 20), or have had a teaspoonful or two of spirit burnt in it, and be then half filled with sterilized

water. Water is preferable to carbolic lotion, which benumbs the fingers and lessens the necessary delicacy of touch. The water in the tray should be enough to cover all the instruments, and if not required at once, dust should be kept out by covering the dish with a sterilized towel. Graefe's knives are prepared by washing with wool soaked in absolute alcohol, not by boiling, which blunts them and destroys their temper. Some knives of good temper can be used thirty and even forty times before they are blunted; others become blunt after three or four sections. It appears to depend on the temper of the steel.

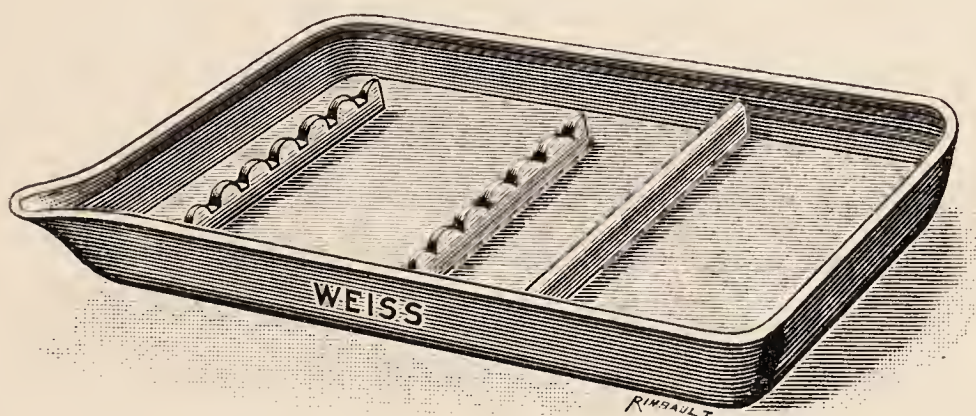


FIG. 3.—Porcelain tray with rack.

The towel used to cover the patient's forehead or the perforated sheet (useful for operating on *purda-nashin* women) should be boiled in an ordinary sauce-pan for at least half an hour and allowed to cool before use.

If the same instruments are required again at once for another clean operation, as when several cataracts are waiting, they are placed in a tray of carbolic lotion (1 in 40) as done with, and an assistant with clean hands rubs them well with wool soaked in the lotion. They are then transferred to a fresh tray full of sterile water for use. Provided they have touched nothing septic, this is sufficient, otherwise reboiling is necessary.

It is always advisable to keep two separate cases of eye instruments, one for ordinary and the other for septic cases. The latter is required for paracentesis in hypopyon, Sæmisch's operation, cases of panophthalmitis, dacryo-cystitis, etc. It need only contain a speculum, fixation forceps, knives, sharp curette, probes and scissors. They are best sterilized (except the knives) in the flame of a spirit lamp and then put in 1 in 40 carbolic lotion or sterile water before use.

Dressings.

Pads are cut out from gauze and folded in eight layers. This gauze has been boiled in mercuric iodide solution (1 in 10000) for half an hour. This is safer than trusting to sterilization by steam. The steam is rarely superheated as it ought to be, except in the larger sterilizers of Schimmelbusch, which are usually only available in large and well-equipped hospitals.

After boiling, the pads are kept soaking in 1 in 10000 lotion until required, when they are squeezed with clean hands and applied damp. If they are applied damp from stronger lotion, the skin of the lids and forehead is apt to become blistered. When two pads are squeezed out for the two eyes, it is as well, in separating them after squeezing, to apply the inner surfaces that have not come in contact with two hands to the eyes, so as to lessen the chance of infection by the hands. If steam is used, care should be taken : (1) that the dressings should be warmed before the steam is introduced ; (2) that the steam should enter from above and not below, as air is heavier than steam and has to be driven out by it (this bars most of the sterilizers in general use) ; (3) that the steam should be under some pressure ; and (4) that after

sterilization the dressings should be dried. The generally accepted view that dry aseptic dressings check the growth of organisms better than dressings impregnated or wet with antiseptics, does not hold for the eyes. The conjunctival sac with closed lids form an ideal warm moist chamber. If germs are already there, they will develop whether dry or moist dressings are used. If there are none present, dressings impregnated with antiseptics are more likely to keep them out than simple aseptic dressings, while dressings boiled in antiseptics are safer than dressings rendered indifferently aseptic.

Over the moist antiseptic pads are applied dry pads of Gamgee tissue or wool between layers of gauze. In removing pads from the eyes, they should be taken off from above downwards ; if removed from below upwards, they drag open the upper eyelid, hurt more, and make the patient screw up the eye while the lid is perhaps held half open by the pad, and in this way the wound may be forced open.

During the cold season, lotions, pads, etc., should be applied warm to avoid causing the patient to screw up his eyes. The bandages are made of muslin (māl-māl), and are three yards long by two inches wide. After most operations merely protective bandages are needed. If pressure bandages are required, more dry pads can be used and the bandage more firmly applied.

Swabs of absorbent cotton wool are kept soaking in mercuric iodide solution 1 in 5000, and with a cover over them, ready for use after having been boiled in the same.

Nail-brushes are prepared when new by boiling for half an hour or by steaming for half an hour. They are kept constantly lying in a glass jar of 1 in 2000 mercuric

iodide lotion, and after use before being put back, they are placed in boiling water. The lotion should be changed daily when the brushes are in use. Any kind of *soap* prepared by the hot process may be used. It is only of use in removing grease and superficial dirt. Carbolic soap is as good as any.

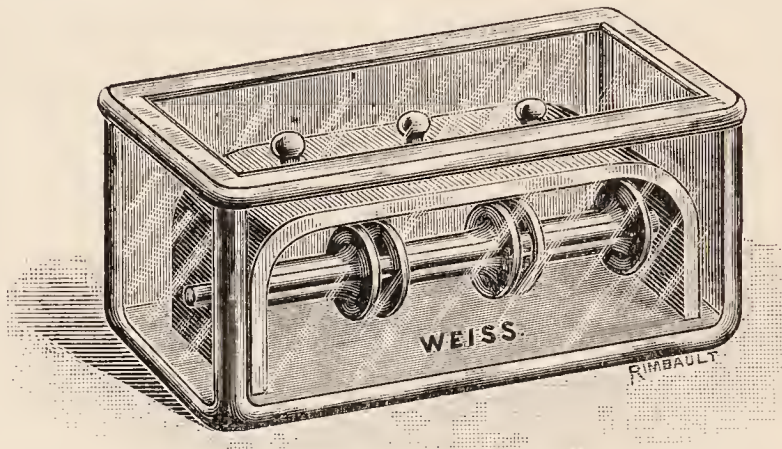


FIG. 4.—Glass ligature trough with three reels.

Silk for ligatures and sutures requires careful boiling. It may be wound on glass bobbins and placed in the sterilizer with the instruments. A glass jar, used for keeping lotion, silk, etc., in, should have a lid that completely covers the mouth, and not one that sinks in and forms a receptacle for dust which falls in each time it is removed (fig. 4).

Lotions.

For washing the face, mercuric iodide solution (1 in 2000) is used, after the soap and water scrubbing. For washing out the sac and during operations mercuric iodide solution (1 in 5000) is used. This has the advantage, not possessed by perchloride, of not combining with albumen and so of not converting blood into a sticky mess. It also discolours instruments less. It is not decomposed with alkalies. The lotion is best kept in concentrated form for use in hospital.

Newman* gives some useful formulæ. If pure mercuric iodide is available, take—

Mercuric iodide	...	...	8·75 grains.
Potassium iodide	...	...	6·50 „
Water	...	...	20 fluid ounces.
= 1 in 1000 mercuric iodide solution.			

If not available, take—

Mercuric perchloride	...	...	5 grains.
Potassium iodide	...	...	13 „
Water	...	...	20 fluid ounces.

Shake till a clear solution is formed = 1 in 1000 mercuric iodide solution.

Either of these may be kept in greater strength, if required, but the dilutions must be carefully carried out. They should be coloured with aniline, picric acid, or turmeric. If hard water is used, more iodide of potassium will be required to dissolve the red iodide of mercury which tends to become precipitated ; as Newman points out, the “ name biniodide is strictly correct, but the strength is usually (not always) expressed in terms of mercuric iodide, the active ingredient. It is desirable that this should always be the case, for, if the strength is (strictly correctly) stated in terms of biniodide, the strength of the active ingredient is reduced by more than a half.” Biniodide lotion of 1 in 1000 is the same as mercuric iodide lotion 1 in 1700. In private practice soloids (Burroughs and Wellcome) are more useful. Each containing 8·75 grains of the double salt, with a pint

* *Manual of Aseptic Surgery*: Major E. A. R. Newman, I.M.S. Calcutta, Messrs. Thacker, Spink & Co., p. 106.

of water, gives 1 in 1000 biniodide or 1 in 1700 of mercuric iodide lotion, coloured blue.

Perchloride solution may be kept in stock in the following solution, which should not, however, be used until two days after preparation, unless pure distilled water has been available for it :—

Perchloride of mercury	...	10 grains.
Chloride of sodium	...	10 „
Water	...	20 fluid ounces.

This gives roughly a 1 in 1000 solution, and fuchsin may be added to distinguish it from the mercuric iodide solution which can be stained with aniline blue or picric acid ; all mercurial lotions are liable to render the cornea hazy, in some cases permanently. The weak solutions are less liable to do this. If they obtain access to the interior of the anterior chamber, it is more likely to happen. It is best avoided by irrigating the sac with saline after the use of perchloride, especially in cases where the anterior chamber is to be opened.

Boracic lotion (gr. x ad. ʒi) or *sterilized saline solution* (0·6 per cent.) may be used for washing out the conjunctival sac. The latter is used for irrigating the anterior chamber. *Formaldehyde* 1 in 1000 to 1 in 2000 (made from formol, which is a 40 per cent. solution of formic aldehyde), is a strong antiseptic and has a marked effect in diminishing conjunctival secretion. It is usefully applied in a stronger solution (1 in 100) to the edges of the wound in commencing suppuration after cataract extraction, but its application is painful.

Oxycyanide of mercury is a less irritating antiseptic than the perchloride and does not injure metallic instruments. It is soluble in water and is used in solutions

of 1 in 560 to 1 in 1000 for irrigation of the conjunctival sac, and 1 in 5000 for subconjunctival injections.

For irrigation glass *undines* or flasks, such as those used in chemical laboratories, are useful (fig. 5).

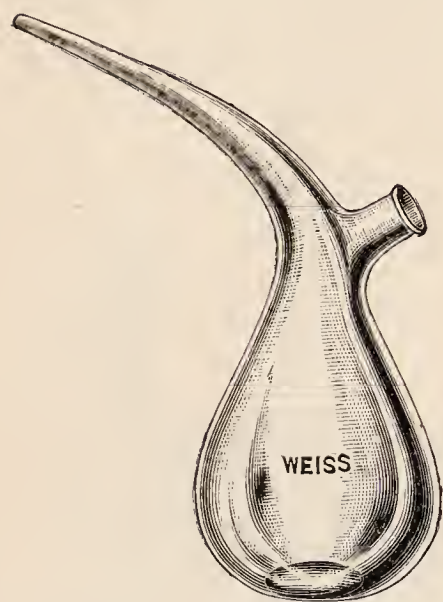


FIG. 5.—Glass undine.

In their absence it can be carried out by soaking swabs of absorbent wool in the lotion and squeezing them over the eye with lids held open. For irrigation of the anterior chamber the only safe thing to use is sterile normal saline solution.

Iodoform seems to act mainly by inhibiting the action of bacteria. It is not always pure and may actually convey infection in the dry state. It is usual to wash it well for twenty-four hours in 1 in 20 carbolic lotion, then in sterile water, and then to dry it under cover before use.

Hydrogen peroxide is useful in suppurative conditions owing to its oxidizing action. It may be used in a 3 per cent. solution.

Fomentations may easily become a source of infection in a hospital unless care be taken that the flannel or gauze used is used absolutely for the case concerned only and for no other, and destroyed after use. This is the more important as the cases for which they are used are often septic.

Eye drops.—The sterilization of these, and of the means of applying them, is of importance. If only small quantities are made up at a time, boiling once does not destroy the effect of the drugs and insures the sterility of the solutions. Some drugs suffer less than others, *e.g.*,

boiling eucaïne or alypine solutions appears to have no injurious effect whatever. Using small quantities and boiling them is safer than trusting to making the drugs up with weak biniodide or perchloride solutions. For the bottles and droppers Ströschlein's are as convenient as any (fig. 6). The rubber teats on the droppers are the

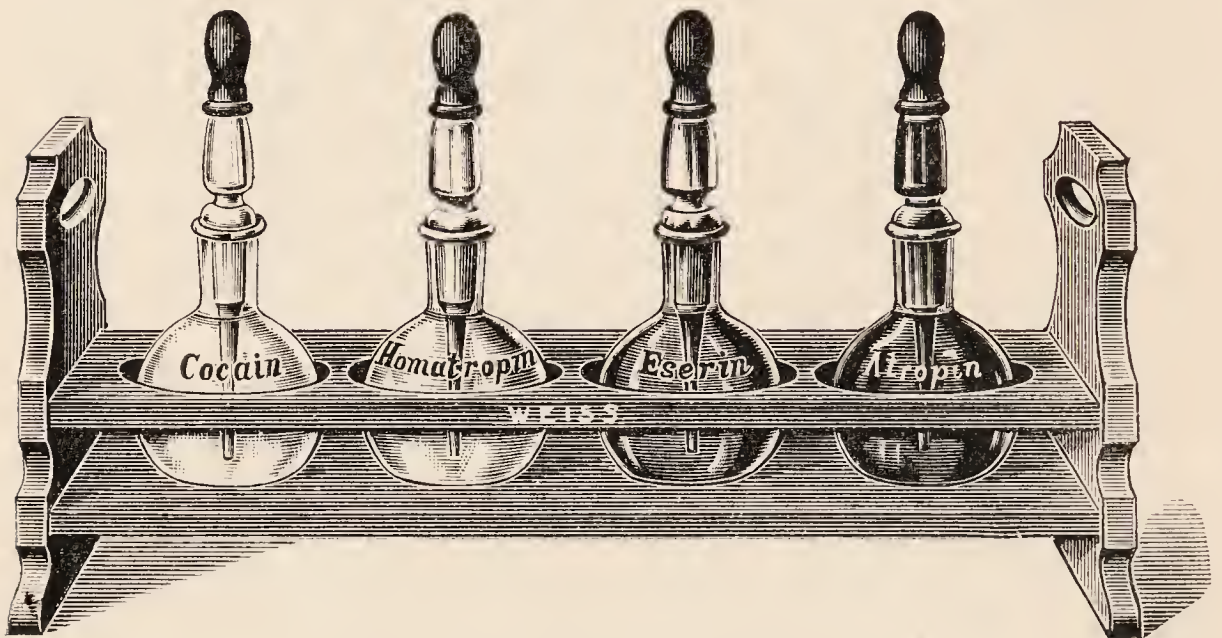


FIG. 6.—Ströschlein's apparatus.

weak part of the apparatus. They can be cleaned by soaking for twenty-four hours in mercurial lotion. After a little use they become loose and require tying on to the glass dropper to make them suck up the lotion. This increases the work of sterilization, but cannot be helped. To sterilize them the teats are removed, the glass dropper inverted and the bottle is then heated over the tripod upon a spirit lamp until the lotion inside has been boiled three or more minutes (fig. 7). The steam rising from it sterilizes the dropper. Separate Ströschlein's apparatus should be kept for out-patient work and for septic and other cases in the wards.

In the present chapter the various possible sources of infection likely to be met with in performing ophthalmic operations have been incidentally mentioned. It will be

as well to recapitulate them here and place them in the order of their respective probability and danger, as it is only by carefully guarding against them that success can be obtained. Danger may arise from (1) the lacrymal passages, (2) the conjunctival sac, (3) the lid margins, (4)

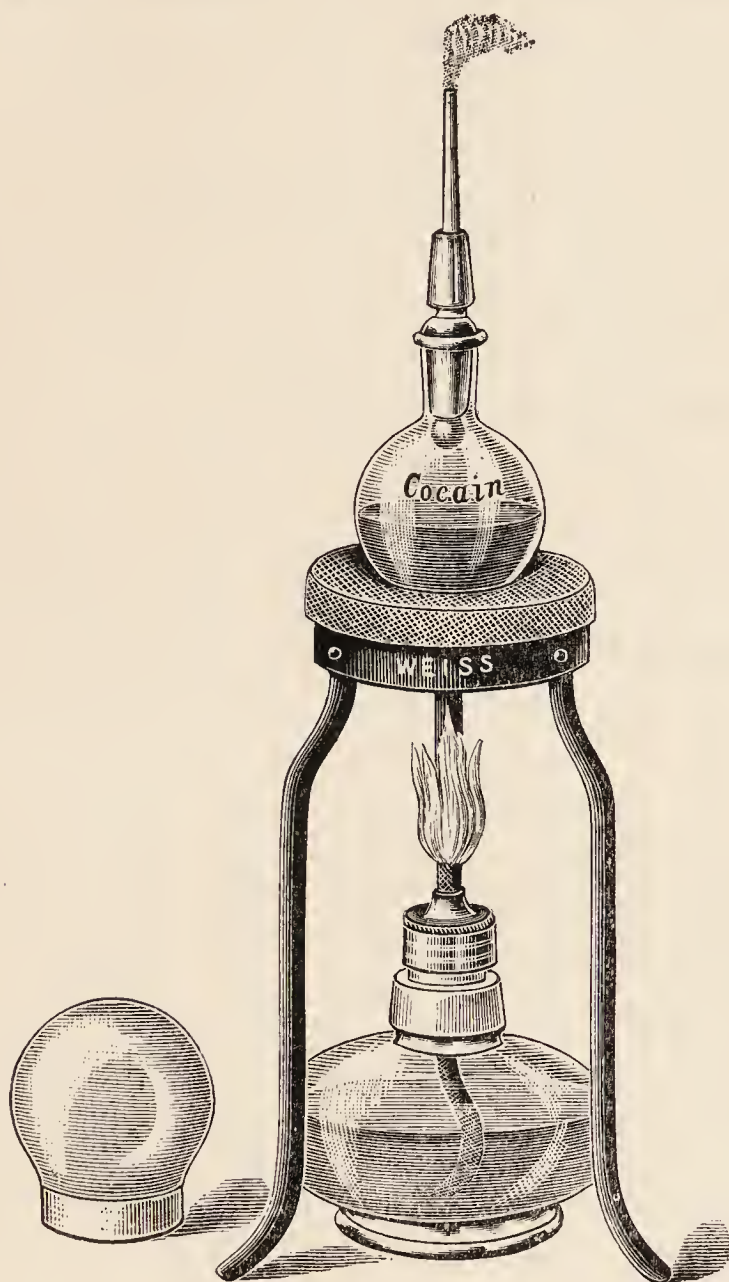


FIG. 7.

salivary infection from operator or assistant, (5) instruments, (6) surgeon or assistant's hands, (7) lotions, eye drops, etc., (8) dressings, swabs, etc. Lastly, the patient may infect himself in spite of all our care. In Indian hospitals where the majority of our patients are uneducated and uncommonly stupid, auto-infection is not rare

and is very difficult to prevent. The intense curiosity to know how things are going on, or the determination to continue ordinary habits, especially as regards eating and attending to the calls of nature, are largely responsible for this. Good nursing is the best means of fighting it.

Note.—For ward work it is useful to have a tray, provided with a handle, carried round, while the cases are being dressed. On it the following will be found useful:—

Two enamelled sauce-pans with lids—in one are the gauze pads, and in the other the wool swabs, in the weak mercuric iodide lotion in which they were boiled. The coolie carrying the tray lifts the lids off as required.

Metal sterilizer-container with dry pads and bandages in it.

Ströschein's frame with four bottles containing:—

Solution of cocaine	4 grs.	to	1 fluid. oz.
„ atropine	2 „	„	1 „ „
„ eserine	2 „	„	1 „ „
„ dionine	10 „	„	1 „ „

Solution of nitrate of silver, 2 p.c.

Wool swabs on sticks.

Scissors for cutting eyelashes.

There are also carried round a glass box and bowl, containing boiled nail brush and mercuric iodide lotion, and an enamelled bucket for dirty dressings. Each ward has a wash-hand basin and tap supply.

CHAPTER III.

GENERAL AND LOCAL ANÆSTHESIA.

General Anæsthesia.

GENERAL anæsthesia is comparatively little used now-a-days in ophthalmic operations. Formerly it was used for all cataracts, many iridectomies, for glaucoma and many other operations. The precautions usual in general surgery should be taken before administering chloroform or other general anæsthetic in eye cases. Professor Haab lays much stress on the great risks incurred in giving chloroform, and undoubtedly in one respect the risk is greater than in general surgery. The corneal reflex is one of the last reflexes to disappear, and by the time it is in abeyance, the patient is deeply under, and not far from the borderland. The application of cocaine will abolish corneal sensation, of course, and so render section of the cornea possible before the anæsthesia is profound, but at the same time its use removes two important guides to the patient's condition, *viz.*, the reflex itself and the alterations in the size of the pupil. When the other eye is available this does not matter. It often is not available however. In India the risks of chloroform are regarded as very slight ; few men have seen dangerous symptoms from its use in Indian practice. This is probably due, partly to the very careful observation given to the respiration as a result of the teachings of Lawrie, and partly to the fact that most

operations in India are performed practically in the open air. Even in the hottest season when the doors and windows have to be kept shut, punkabs keep the air in constant motion and the ventilation is free. The patient, as well as the staff, always have plenty of fresh air, unlike the conditions prevailing in many of the European operation theatres, which are sometimes the subject of comment among surgeons from India visiting them.

The cases in which general anæsthesia is required are :—most eye operations and even many examinations in children, operations for acute and subacute glaucoma, enucleation, removal of orbital tumours, extirpation of the lacrymal sac, and plastic operations.

Local Anæsthesia.

The discovery of the anæsthetic effect of cocaine in 1884 by Köller revolutionised ophthalmic surgery. Since then many new local anæsthetics have been introduced, mostly of synthetic origin, but cocaine still maintains its position as the most generally useful and satisfactory of them. The mode of action and advantages and drawback of cocaine and its substitutes are given in tabular form at the end of this chapter.

Of all these local anæsthetics cocaine may be said to be the most generally useful. For operations where the iris may be cut a 5 per cent. solution is instilled three times at intervals of five minutes. For squint operations this strength is necessary, and by combining it with instillation of adrenaline, 1 in 1000 solution, the operation is rendered bloodless and painless. Eucaine Beta and alypine are good local anæsthetics but their vaso-dilator effect is objectionable, and has to be counteracted with adrenaline, which it is not always advisable to use. Both

cause considerable smarting at first. For sub-conjunctival and hypodermic injection eucaine or novocaine are all very effective in 2 per cent. solutions, and none of them suffer harm by boiling, which is important when the solution is to be injected into the tissues. Holocaine is a rapid anæsthetic and is slightly antiseptic; it is useful in cases where deep anæsthesia is desired. The drawbacks to it are its poisonous properties, and its vaso-dilator effects necessitating the use of adrenaline along with it. It should not be used hypodermically on account of its poisonous effects.

For sub-conjunctival and hypodermic injection Barker's solution is convenient. It is—

Eucaine Beta	...	...	0·8	gramme (12 grs.)
Sodium chloride	...	...	0·2	„ (3 „)
Adrenaline solution (1 in 1,000)	0·001	gramme	(17 mms.)	
Distilled water	...	100·00	gramme	(3½ fl. oz.)

140 minims of this contain one grain of eucaine. Anæsthesia is not at its maximum until about fifteen or twenty minutes after injection.

To prevent pain in sub-conjunctival injections of saline or mercurial salts, the addition of a quarter up to a half of the syringe of acöine solution (1 per cent.) is necessary.

As salt causes precipitation of the acöine, at any rate in 5 per cent. and stronger solutions, the injection must be made rapidly after the syringe is filled.

DRUG.	Mode of action.	Mode of use.	Advantages.	Disadvantages.
COCAINE	... Slight smarting at first, anæsthesia in 1"—3" lasting $\frac{1}{2}$ hour. Is a vaso-constrictor. Lowers tension. Dilates pupil, affects Ac., softens epithelium.	1 to 5 p. c. solutions, also crystals from alcoholic solution. Incompatible with borax, mercurous and mercuric chlorides.	Good and deep anæsthesia with anæmia.	Is not an anæsthetic in inflamed eyes, risk of epithelial abrasion if eye not kept closed from drying, poisonous—if absorbed (<i>via</i> nasal duct).
EUCAINE β	... Much smarting, complete anæsthesia in 2", lasting 15". Vaso-dilator. No effect on pupil, T. or Ac.	2 p. c. solution, combined with adrenaline.	Only slightly poisonous; excellent for hypodermic injection, salt added increases its analgesic effect. Boiling does not injure.	Hyperæmia and so more hæmorrhage.
HOLOCAINE	... Slight smarting, anæsthesia $\frac{1}{2}$ "—1", lasting 15"—20". Slightly vaso-dilator. No effect on pupil, T. or Ac. or epithelium.	1 p. c. solution; keep in porcelain not glass vessels.	Rapid effect, deep anæsthesia (iris), boiling does not injure. Is an antiseptic.	Irritating & poisonous, unsafe hypodermically; bleeding after it, as is a vaso-dilator.
TROPACOCAINE	... No smarting, anæsthesia $\frac{1}{2}$ "—2". No effect on vessels, pupil, T., Ac. or cornea.	1 to 5 p. c. solution in normal saline, to prevent irritation (Swanzy).	Rapid powerful and lasting anæsthesia. Stable, cheap and less poisonous than cocaine.	Irritating even with salt. Injection of over $\frac{1}{2}$ gr. dangerous.
ACÖINE	... Anæsthetic lasts $1\frac{1}{2}$ to 2 hours, only acts when epithelium broken. No effect on pupil, Ac. or vessels.	1 p. c. solution, keep sol. in dark and in bottle washed out with hot H.Cl. and then distilled water.	Useful to add to Na. Cl. or Hg. Cl. ₂ solutions for sub-conjunctival injection—it abolishes the pain.	No use applied to unbroken cornea. Is said to increase adhesions following sub-conjunctival injections.

STOVAINE	...	Smarts, anæsthesia in 2" lasting 6". Is a vaso-dilator and miotic. No effect on T., slight only on epithelium.	4 p. c. in normal saline solution.	Less toxic than cocaine, useful hypodermically.	Is irritating and evanescent. Iris not rendered insensitive.
ALYPINE	...	Smarts, rapid anæsthesia, vaso-dilator. Slight mydriasis. No effect on T. or Ac., and very slight on epithelium.	2-3 p. c. solution ...	Rapid and complete anæsthesia. Not decomposed by boiling.	Hyperæmia—more bleeding.
NOVOCAINE	...	Rapid anæsthesia ...	2 to 3 p. c. solution.	Not poisonous—six times less so than cocaine. Not irritating. Not decomposed by boiling.	Is of recent introduction. Drawbacks still to be ascertained.
USE OF ADRENALINE WITH ABOVE.	...	Is a vaso-constrictor ...	1 in 1,000 solution. Parke Davis & Co.'s solution is the most generally satisfactory.	Used with vaso-dilators, it counteracts their hyperæmic effect.	Reactionary bleeding may occur. Superficial vaso-constriction is accompanied by hyperæmia of deep parts. Irido-cyclitis sometimes aggravated by it and glaucoma set up. Experimentally it produces atheroma in animals.

CHAPTER IV.

IRIDECTOMY—IRIDOTOMY—ANTERIOR SCLEROTOMY—
POSTERIOR SCLEROTOMY—LAGRANGE'S OPERATION—
HERBERT'S OPERATION.

Iridectomy.

Indications.—For optical purposes iridectomy is of use in cases where rays of light cannot reach the retina owing to opacities of the cornea, closure of the pupil, zonular cataract or stationary central opacity of the lens. Iridectomy is also performed for the reduction of high intra-ocular tension in cases of glaucoma, and in cases of exclusion of the pupil where glaucoma may be expected. It is also indicated for the removal of foreign bodies and tumours in the iris.

For optical purposes the first essential is that the coloboma shall be made behind clear cornea. The nearer the centre of the cornea it is the better, as the refraction is better there. Near the periphery the surface of the cornea is flatter and aberration is greater. As a rule the smaller the coloboma the better, as the new pupil does not react to light well, not at all usually when done for closure of the pupil, and troublesome glare from too much light entering the eye results if the coloboma is large. If done for a corneal opacity the choice of situation is limited to the clear cornea. If atropine improves the sight an iridectomy is likely to do so too. A blackened diaphragm with a narrow slit in it may be used to find out where the best vision will be. It may be desirable to make

the coloboma wide and near the periphery of the cornea or more usually narrow. The latter is required in cataract extraction and expression and in making a coloboma for zonular cataract and central lenticular opacities. In these latter it is usually made downwards and inwards as the visual axis passes below and internal to the centre of the cornea. Either kind of coloboma can be performed as will be described under "methods." If the iridectomy is for closure of the pupil it is best done upwards, so that the upper lid may be of use in shutting off the excess of light, and in hiding the disfigurement, which is greater in a blue or grey iris than in a brown one. In closure of the pupil the operator must be prepared to sometimes find the lens opaque from secondary cataract. In such cases the wound in the cornea should be enlarged by scissors and the lens extracted by Wenzel's method (p. 58).

In glaucoma iridectomy is indicated in all acute and sub-acute cases, and the earlier it is done the better the results. In chronic cases, iridectomy is not so unconditionally indicated. If the case is recognised early, the chance of iridectomy preventing its further progress is best. Cupping of the optic disc is a more reliable sign of pathological increase of tension than palpation. If there is still useful sight in both eyes when the case is first seen, iridectomy should be done in one eye, and miotics be used for the other until it is seen what the result is in the operated eye. If beneficial, the other eye may then be iridectomised. The more chronic the disease the more important it is that the incision and the excision of the iris should be quite peripheral on account of the adhesions that form between the iris and the sclero-cornea.

In exclusion of the pupil, iridectomy is indicated to restore communication between the posterior and the

anterior chambers and prevent the development of secondary glaucoma.

Instruments :—Clark's speculum (fig. 8), fixation forceps (fig. 9), iris forceps (fig. 10), Tyrrell's hook (fig. 11), Graefe's cataract knife (fig. 35), or (and) Jaeger's keratome (figs. 12 & 13), spatula (fig. 14), Maunoir's angular iris scissors (fig. 38), or De Wecker's scissors (fig. 15).

Anæsthesia.—In adults, local usually. In acute glaucoma a general anæsthetic is required—particular care being taken to prepare the patient properly for the operation so as not to have vomiting afterwards, if possible. With patients of good nerve the application of crystals of

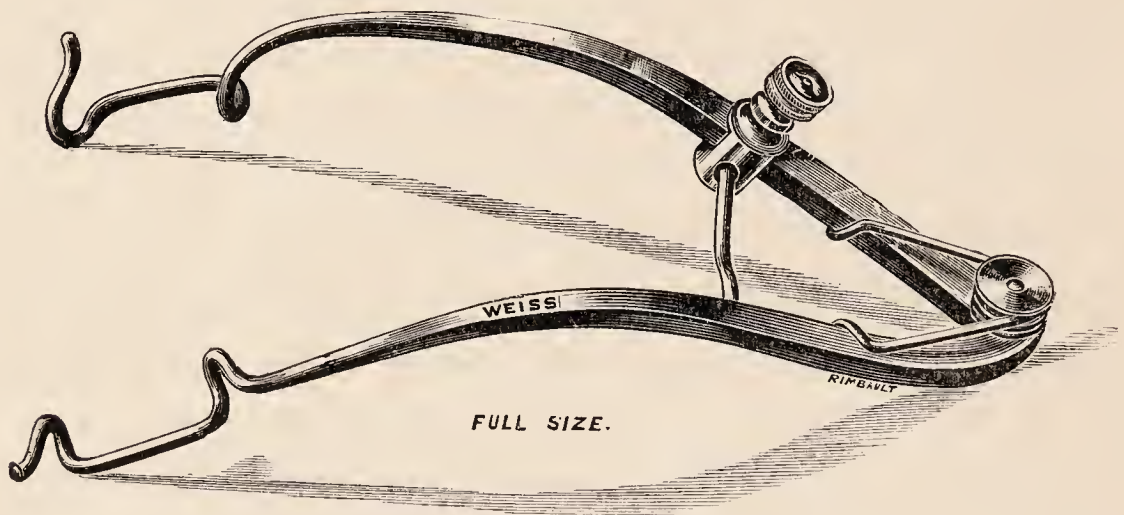


FIG. 8.—Clark's speculum.

cocaine on the line of incision, after previous instillation of cocaine solution, may suffice, and avoid the use of general anæsthetic. The use of adrenaline is not to be recommended. The superficial blanching is believed to be accompanied by deep congestion, and there is the likelihood of reactionary hæmorrhage also. In young children chloroform is usually required for any kind of iridectomy.

Methods.—(1). *For optical purposes*.—In making an iridectomy upwards in the right eye, the speculum having been inserted, the bulbar conjunctiva is grasped

with the fixation forceps held in the left hand on the opposite side of the cornea to where the corneal incision is to be. The keratome is held in the right hand and its point entered in the limbus, the blade being held at right angles to the surface. If the incision is made too far into the cornea, its site becoming opaque hinders light from entering through the newly-formed coloboma, and this is to be avoided. As soon as the keratome's point is seen glistening in the anterior chamber, the handle of the

knife is lowered so as to bring the triangular blade parallel to the anterior surface of the iris, and the knife is pushed steadily on towards the centre of the pupil until the width of the incision is a quarter of an inch. (Plate V). The knife point must now be tilted forwards towards

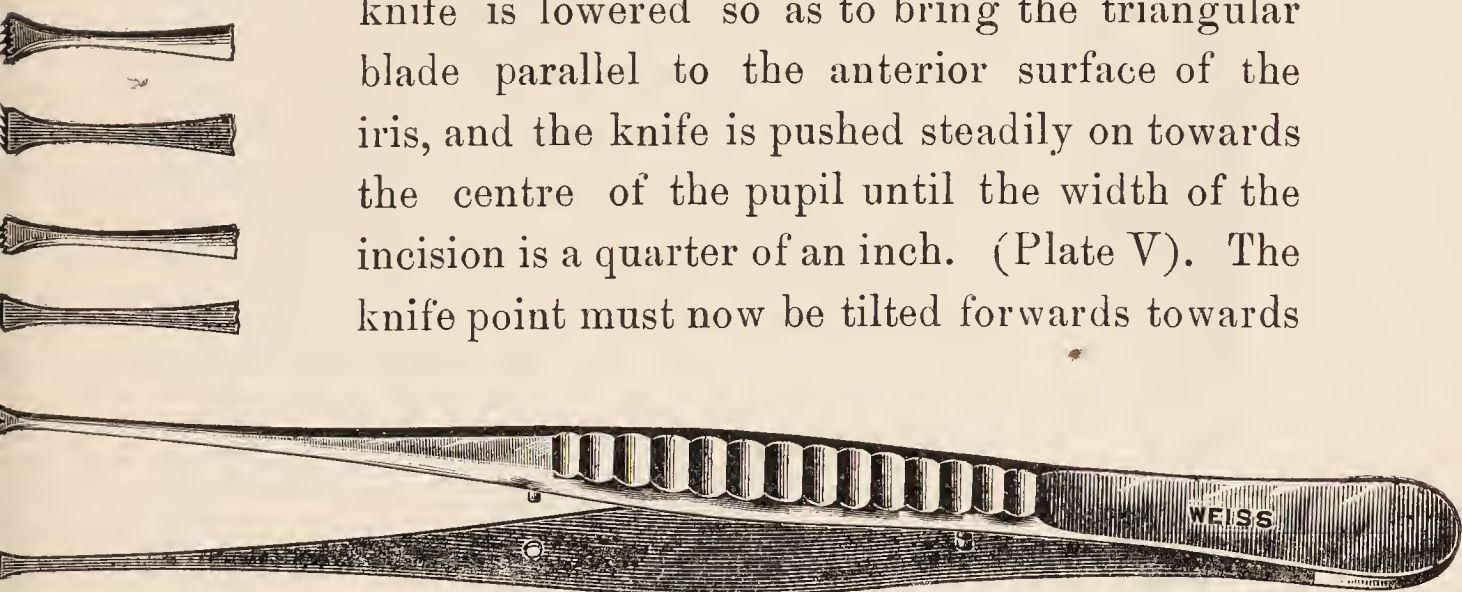


FIG. 9.—Fixation forceps.

the back of the cornea, *i.e.*, the handle is depressed, so as to avoid injuring the capsule of the lens while the knife is being withdrawn as the aqueous humour always begins to escape then and the lens falls forwards. As the blade is withdrawn, it may be made to enlarge the incision towards one or other angle if required. If Tyrrell's hook be used instead of iris forceps, a smaller incision suffices. The fixation forceps is handed to the assistant who fixes the eyeball with it. The operator holding the iris forceps in his left hand passes the points in closed into the anterior chamber, with a gentle side to side motion so as to slip over the iris without catching, opens

them when they have reached the pupillary border of the iris and gently seizing that border, withdraws it through the wound, and cuts off the portion of iris drawn out



FIG. 10.—Iris forceps.

with the angular scissors, the blades of which are held at right angles to the incision (Plate II). This gives a narrow coloboma extending further from the pupil to the periphery the more the iris scissors are pressed down on the incision. If a broader coloboma is desired, the scissors may be used parallel to the length of the wound in the cornea and a larger piece of the iris taken hold of. The iris should be *gently* grasped with the iris forceps. Firm seizure causes pain and flinching, with possible accidents. Tyrrell's hook is less painful than iris forceps. It is passed in on the flat, rotated to hook the edge of the iris, rotated back and withdrawn. The spatula is then passed in at each angle of the wound to replace the pillars of the coloboma, and to allow any blood there may be in the anterior chamber to

escape, the conjunctival sac is wiped out with a swab, atropine instilled, and a pad and bandage applied. If the iridectomy is being made on the inner side of the right or the outer side of the left eye, the hands will have to be reversed in the above description. The chief difficulty is, even to an ambidextrous surgeon, the use of the scissors by the left hand which requires a little practice. The handles have to be pressed across one another, the opposite way to what



FIG. 11.—Tyrrell's hook.

one's instinct leads one to try. In using scissors in the right hand pressing the thumb down makes the blades cut better. With the left hand, the scissors being the same, the thumb must be drawn up whereas one's instinct is to push it down. A moment's trial with any scissors will make this clear. With perfect scissors the matter is of no consequence, but as the scissors get older and the joint looser, the point is of considerable importance.

As this is the first operation in this book dealing with the interior structures of the eyeball, one or two other points that apply to all such operations may be mentioned. Though a steady hand is a very valuable possession in ophthalmic surgery, it is not an absolute necessity, as the good results obtained by surgeons without one show. Moreover, steadiness must not be



FIG. 12.—Jager's iridectomy knife.

FULL SIZE



FIG. 13.—Side view of fig. 12.

FULL SIZE

confused with rigidity. It certainly should not be combined with it. Suppleness and a readiness to adapt oneself immediately to unforeseen conditions is preferable to steadiness *per se*. Steadiness, if not natural, may be acquired, partly by practice and partly by taking advantage of what support nature provides. The wrist may be steadied on the side of the patient's head, and the little or little and ring fingers may rest on the patient's cheek or forehead, in using fixation forceps. In using scissors the hand may be steadied in the same way, and additional steadiness may be obtained by using the middle instead of

the index finger in the ring of the scissors, supporting the scissors by placing the index finger further up the shank nearer the joint as in Plate II. In inserting the speculum the blades should be held almost closed, with the screw partly unscrewed, between the finger and thumb of the hand corresponding to the eye to be operated upon. The upper blade is then passed under the upper lid which is raised for the purpose by the index finger of the other hand. The lower lid is then drawn down by the thumb of that hand and the lower blade inserted inside it. The blades are allowed



FIG. 14.—Spatula.

to open wide, and it is usually better to then close them just a little before fixing them in position by the screw. This lessens the strain on the lid and is much more comfortable to the patient; it often in fact makes all the difference between his keeping quiet and continually trying to screw up his eye. Where the lids are very lax it may be necessary to keep the speculum opened to the maximum in order to

retain it. Such patients are often quiet naturally. In using fixation forceps care must be taken not to press upon the globe with them and not to pull with them either. The former may cause prolapse of the globe.

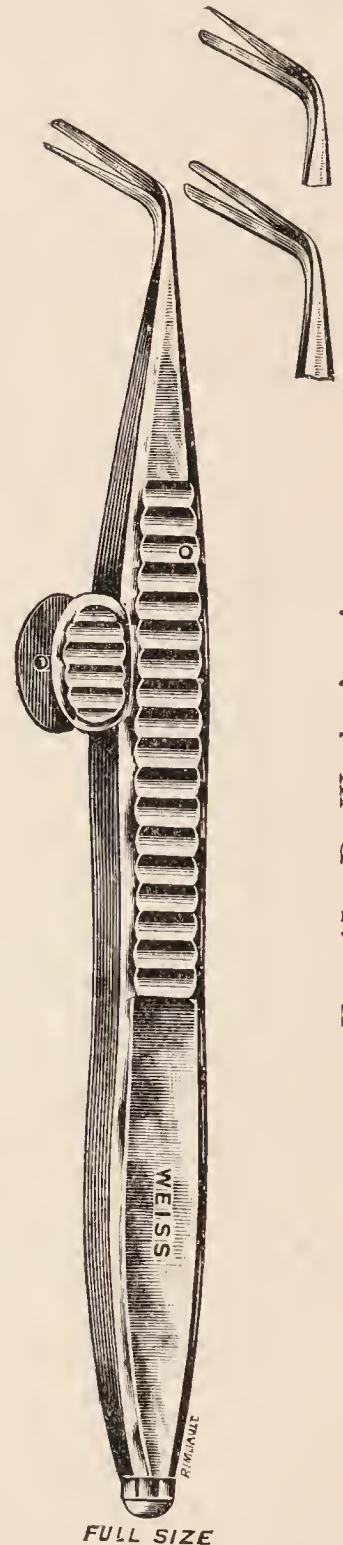


FIG. 15.—De Wecker's scissors.

contents, the latter tearing of the conjunctiva. A good hold should be taken of the conjunctiva, and should the forceps slip in spite of this, the hold may be made firmer by rotating the points without any relaxing of the grip.

Accidents:—Puncture of the lens capsule is the greatest and most serious accident. It can be avoided by the precautions mentioned under “Methods.” If the anterior chamber is very shallow as it sometimes is where there are anterior synechiæ, it is safer to use a Graefe’s knife. It need not even be made to pass in and out of the anterior chamber before cutting out, but the point may be made to merely enter the chamber and then enlarge the opening slightly in a lateral direction. If there are many posterior synechiæ it may be impossible to remove enough iris tissue to obtain vision. Wenzel’s operation may then be necessary.

After-treatment:—Daily dressing with use of atropine for three days, by which time the wound is healed enough to do without a bandage, and a shade may be applied.

(2). *For glaucoma*:—(a) *With Graefe’s Knife*:—This method avoids the danger of damaging the lens capsule, which exists when the keratome is used, and it enables the incision to be made very peripherally which is desirable. On the other hand, it is difficult to use Graefe’s knife when the anterior chamber is very shallow and the iris easily gets in front of the knife and is cut by it. This is not of so much consequence where general anæsthesia is used. The speculum being introduced and the (right) eye fixed as described on p. 33, the Graefe’s knife point is entered through the sclero-corneal junction at 4-30 o’clock and brought out at 7-30 o’clock making

an incision five-eighths of an inch long.* The point should be aimed towards the centre of the pupil and almost at a right angle to the surface until its tip is seen in the aqueous. This is to prevent its passing between the corneal layers and to ensure its entering the anterior chamber. Its direction is then at once altered so as to aim for the point of exit, and it is passed on to the counter-puncture parallel to the iris plane. The knife is made to cut out very slowly in the same plane, making the escape of the aqueous as gradual as possible. The edge of the knife should be turned a little forward towards the end to avoid making the incision too peripheral, and to avoid obtaining too large and vascular a conjunctival flap. As the cornea is set in the sclera like a watch glass, the inner edge of this incision is in corneal tissue near the angle of the anterior chamber, and the outer edge is in scleral tissue nearly an eighth of an inch

* To define the points of entry and exit of the knife in different operations the front of the cornea is regarded as a clock or as a target.

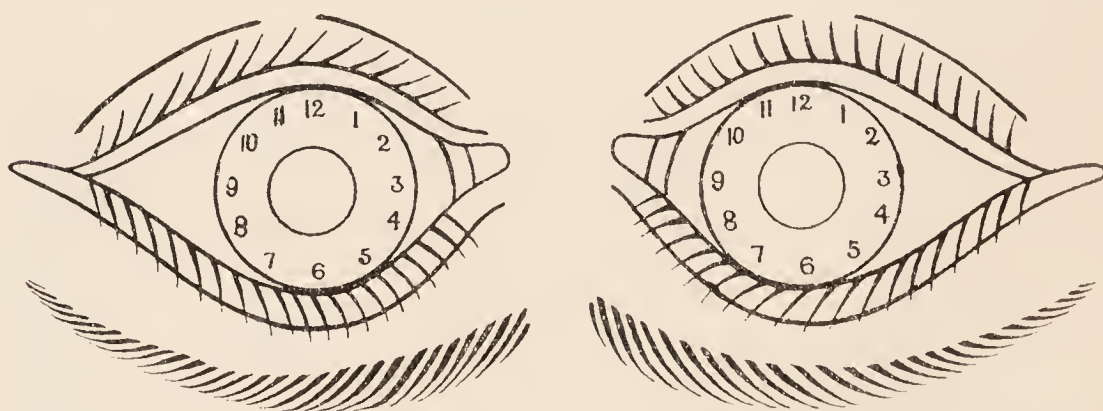


FIG. 16.—Diagram of eyes showing clock face or target method of defining position of puncture, counter-puncture, etc.

The hours are marked on, however, as the operator, not as the spectator, sees them, *i.e.*, 12 o'clock is below, 6 o'clock is above, three o'clock to the right, and 9 o'clock to the left in each eye. This is in accordance with the method followed throughout this book of showing the eye as the operator sees it, the reverse of the text-book method. (Fig. 16.)

from the cornea (fig. 17). The flap should be turned back on to the cornea, and this may be done with the knife or a swab.

The fixation of the eye is now handed over to an assistant who is reliable and will not poke the forceps into the eyeball, and who will rotate the points of the forceps in the conjunctiva, if necessary, to get a better hold, and draw or push the globe steadily down just far enough to enable the excision of the iris to be done. With his other hand he should lift the speculum slightly off the globe, if there is any sign of bulging of the wound,

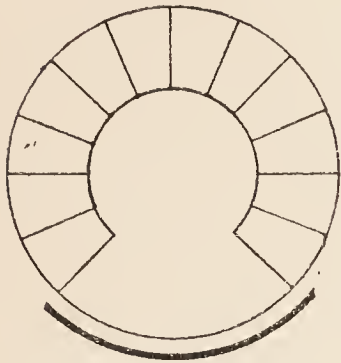


FIG. 17.—Diagram of iridectomy for glaucoma.

or of the iris through it. The closed points of the iris forceps held between the left thumb and first finger are passed into the chamber as far as the pupillary border, opened about an eighth of an inch, and that width of iris seized and withdrawn until slight resistance against its further withdrawal is experienced. Drawing the

iris towards the left, one point of the angular scissors is passed beneath it at the right extremity of the incision, and the iris is cut through from pupillary to peripheral border. The iris held firmly by the forceps is then gently but steadily torn away from its attachment along the whole length of the incision. At the left hand end the iris is drawn towards the right and then is cut through from pupillary to peripheral border. The pillars of the coloboma are replaced with the spatula, eserine instilled in both eyes, and pads and bandage applied to both eyes also.

(b) *With Keratome* :—The point of this is introduced at 6 o'clock as already described (p. 33), only more peripherally, so as to make the line of section in the plane,

of the iris, as described under (a) above. Once the tip appears in the anterior chamber, the point is tilted towards the cornea and kept well away from the lens, while the blade is pushed in until the incision extends over five-eighths of an inch in length. As much, or even more, care is required in withdrawing the knife to avoid wounding the lens capsule. The incision may be enlarged as the knife is withdrawn by cutting along one edge, or scissors may be used. This is better practice than attempting too much by pushing the knife further in and risking traumatic cataract. Handing the fixation of the globe to the assistant, the iris may be excised as already described by a combination of cutting and tearing, or it may be excised entirely with scissors as is more usually done. After seizing and withdrawing the iris in the manner already described (p. 39), the iris scissors (whether curved or straight-bladed does not really matter) are placed in position for cutting with the blades at right angles to the line of incision. This is decidedly easier to effect with angular scissors. They are then pressed down on the globe, while the iris is pulled on steadily, and closed, cutting off the largest amount of iris possible by this method. It is evident, however, that this method removes the peripheral border of the iris only at its centre thoroughly. Elsewhere it is incomplete, and by it the desirability of having the coloboma wider at its periphery is impossible to realise.

The pillars of the coloboma require replacing and the operation is concluded in the same way as described under 1a.

(3). *For exclusion of the Pupil* :—Iridectomy for this purpose is performed as for optical purposes, except in so far as it may have to be modified on account of

possible leucomata present. The iris may be difficult to draw out and generally bleeds freely as it has been diseased. The blood is slowly absorbed. For choice it should be made downwards and inwards, though if there is reason to suppose the lens is cataractous, an upward section would be better, followed by extraction of the lens (Wenzel's operation).

(4). For removal of foreign bodies or tumours localised in the iris, iridectomy as described under (1) should be performed, making the incision at the nearest place to the portion of iris to be removed.

Accidents :—Wound of the lens capsule, especially if the keratome is used, is to be guarded against in the way already described. Bulging of the wound, prolapse of iris and even of the lens may occur at the time of operation or after a few days. The longer the tension has been high and the less it has been possible to reduce it before operation by miotics, the more likely this is to occur. A careless assistant may cause it by pressure with the fixation forceps. In some cases, especially in chronic glaucoma of long standing where the vessels are friable, hæmorrhage may set in at once, blood pouring out of the eye and carrying lens and vitreous with it, the eyeball collapsing and sight of course being hopelessly lost. It may be feared in cases where in spite of the preliminary use of miotics and the careful and slow escape of aqueous at the operation the wound bulges much at the time of operation. In such cases anæsthesia-vomiting may cause it or, even if hæmorrhage does not occur at once, it may come on after some days, on the patient's making some sudden or severe exertion.

After-treatment :—If for glaucoma, daily dressing with use of eserine in both eyes until the wound flattens

down, when a shade may be used. If the tension has not been reduced at the operation and any bulging occur, anterior or posterior sclerotomy should be considered.

Iridotomy.

Division of the iris is useful in cases where, after cataract extraction, there has been iritis or (and) prolapse of iris and the iris has become drawn up until no pupil is left. The iris forms a curtain through which no light can pass. An incision is made under cocaine with a keratome in the cornea through the old incision scar or just in front of it. De Wecker's scissors (fig. 15), are introduced closed into the wound. The blades are then allowed to slightly open and the sharp pointed one, which should be the lower, is made to perforate the iris, and both blades pushed on so that the iris lies between them. On closing them an incision is made through the iris, and by retraction of the fibres an opening may result. Should no retraction, and therefore, no opening to speak of, follow, the result is likely to be a failure. In such a case the iris is usually thickened from inflammation, and it is better to enlarge the corneal incision with scissors and then make two cuts into the iris tissue, one from each corner of the incision. These meet at the centre of the iris and the triangular piece marked out is then removed, leaving a pupil which is less likely to close than the opening left by a single iridotomy. Bleeding is usually considerable and it is some time before the full benefits of the operation are realised. Dressing and after-treatment are as for iridectomy.

Anterior Sclerotomy.

Indications :—Anterior sclerotomy is useful in advanced cases of congestive glaucoma, seen too late for

iridectomy, and its performance, repeated if necessary, lessens the painful sufferings of the patient; in cases of congestive glaucoma where iridectomy has failed to give relief; in hæmorrhagic glaucoma; in simple chronic glaucoma it is preferred by some to iridectomy; in the glaucoma coming on after cataract extraction; in the glaucoma of children—buphthalmus; in keratoconus; and, lastly, in the increase of tension following the irido-cyclitis of sympathetic ophthalmitis.

Instruments :—Clark's speculum, fixation forceps, iris forceps, Graefe's cataract knife, keratome, spatula.

Anæsthesia :—Except in children local anæsthesia is enough.

Method :—The pupil should be contracted as much as possible with a miotic before operation, to diminish the shallowness of the anterior chamber and lessen the chance of prolapse of iris. The speculum being inserted, the conjunctiva is firmly grasped by the forceps below the cornea, and Graefe's knife is entered as in the operation for iridectomy for glaucoma (p. 38). The incision lies in the sclero-cornea and the puncture should be well beyond the apparent limit of the cornea as well as the counterpuncture (fig. 18). The knife is made to cut in a plane parallel to the iris for an eighth of an inch at both ends and then withdrawn, thus leaving a bridge of sclero-corneal tissue undivided, *i.e.*, the section is not completed as it would be if done for cataract or iridectomy. The point is directed towards the angle of the anterior chamber as it is withdrawn to prevent the knife wounding the lens, as that structure falls forward when the aqueous escapes.

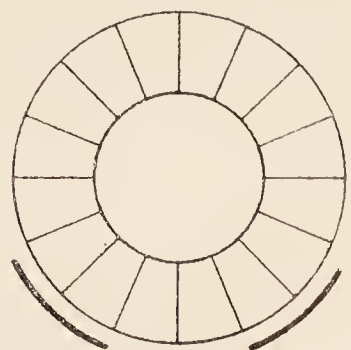


FIG. 18.—Diagram of anterior sclerotomy.

Should the pupil not be round and the iris tend to enter the wound, it should be replaced with the spatula. If this is impossible, it may be drawn out with iris forceps and excised with scissors. The incision described may be made at any part of the circumference of the cornea.

Accidents :—Wound of the lens capsule either in introducing or withdrawing the knife. Preliminary use of miotics, care in not allowing the early escape of the aqueous, and turning the point of the knife away from the pupillary area in withdrawing it, will help to prevent this accident. Should the anterior chamber be too shallow to permit sclerotomy, as described above, to be performed, the operation may be done at one side only of the sclero-cornea by means of a keratome. Prolapse of iris is more likely with this method. However occurring, it should be dealt with as described above.

After-treatment :—Eserine should be instilled into each eye, pads and binocular bandage applied, and the patient kept at rest for some days in bed, the bowels being carefully attended to. Daily dressing and the use of miotics is kept up ; the operated eye only is bandaged after the second day, and a shade applied in three or four days.

Posterior Sclerotomy.

Indications :—This operation may be done in glaucoma to render iridectomy possible when the anterior chamber is too shallow to allow of its being done otherwise, or after iridectomy when the tension has not subsided. In some cases indeed, especially in simple chronic cases, the tension increases instead of diminishing, and the lens bulges forwards blocking the filtration angle. In such cases posterior sclerotomy is the only operation likely to succeed. It is also done in detachment of the

retina to allow of the escape of the sub-retinal fluid, in the hope of the retina becoming reattached.

Instruments :—Clark's speculum, fixation forceps, Graefe's knife.

Anæsthesia :—Local. Sub-conjunctival injection of Barker's solution is advisable also.

Methods :—With speculum inserted and the eye looking inwards, the conjunctiva is grasped on the outer side, a little above the centre of the cornea by fixation forceps. The Graefe's knife is then passed through the upper edge of the fold of conjunctiva thus held up, with its flat surface parallel to the scleral surface. It is passed backwards, and the cutting edge turned towards the sclera through which it is made to enter at a point situated half an inch behind the corneal margin and midway between the recti tendons. This avoids the *venæ vorticosæ* which perforate the sclera half way between the corneal margin and the optic nerve entrance. If done for a detachment, the puncture should be opposite it. The knife is rotated back through a quarter of a circle and withdrawn, and—except when done for detachment—gentle pressure is applied over the cornea through the upper lid for about a minute. This presses the lens backwards and helps to restore the anterior chamber. The pressure may be slowly relaxed giving time for the aqueous humour to reaccumulate.

Lagrange's Operation for Glaucoma.

Indication :—Lagrange of Bordeaux* combines iridectomy with sclerectomy in cases of simple chronic glaucoma, with the object of making a pervious cicatrix (*cicatrice filtrante*) near the canal of Schlemm.

* Lagrange : *Archives d'ophtalmologie*, August, 1906, and *Ophthalmoscope*, September, 1907.

Instruments :—As for iridectomy for glaucoma, with the addition of a fine pair of sharp small-toothed forceps and a pair of scissors sharply curved on the flat.

Anæsthesia :—Local.

Method :—Eserine is instilled before the operation, which is commenced as for glaucoma iridectomy. The knife (Graefe's) is made to cut out slantingly, inclined backwards, *i.e.*, parallel to the surface of the globe, and so taking up a tongue-shaped flap of scleral tissue with it, bevelling it in fact “like the mouth-piece of a flute” as Lagrange puts it. This necessitates a conjunctival flap. The flap is thrown down over the cornea exposing the tongue-shaped scleral flap which is seized with the fine toothed forceps—an assistant meanwhile steadying the globe with fixation forceps—and the scleral flap is then cut off with the curved scissors. A large iridectomy is then made by cutting with scissors up to the angle of the anterior chamber, and the operation is finished in the usual way.

Accidents :—Too much sclera may be taken up and removed, leaving a fistulous cicatrix. A large flap is not necessary. Prolapse of iris may occur, but is stated by Lagrange to be less likely than in the other attempts that have been made to obtain pervious cicatrices, in which an incarcerated prolapse of iris indeed forms part of the design.

After-treatment :—As after iridectomy for glaucoma. The anterior chamber may be several days in forming. The tension is reduced at once and generally remains so permanently.

Herbert's Operations for Glaucoma.

This operation was devised in 1906 by Lieutenant-Colonel H. Herbert, I.M.S. (ret'd.), late Professor of

Ophthalmic Surgery, Grant Medical College, Bombay, and now of Nottingham, with the object of producing an iris-free filtering cicatrix in cases of glaucoma. Various attempts have been made to procure filtering scars but usually the iris has become involved in them, and though in such cases the glaucoma might be cured, the incarceration of the iris remained a danger. Herbert introduced the method of performing sclerotomy with conjunctival infolding, but gave it up because of insufficient control over the size of the resulting cicatrix. The object of the latest of Colonel Herbert's operations is to isolate a small but deep wedge-shaped strip of scleral tissue immediately above the cornea and beneath the conjunctiva, and to leave it there like a disconnected graft of fibrous tissue. It becomes somewhat displaced forward and revascularised, subsequently shrinking and so providing for filtration, while it remains large enough to permanently cover in the gap in the sclero-cornea and to prevent the formation of an open fistulous track.

The following is Colonel Herbert's description of the operation, which he has been kind enough to send me :—

A wedge of sclerotic and cornea, with its apex at or near the posterior surface of the cornea, may be isolated by thrusting a very narrow ($\frac{4}{5}$ mm.) Graefe's knife across the upper periphery of the anterior chamber and then making one vertical cut upwards (figs.



FIG. 19.



FIG. 20.

19 & 20 a) to reach the anterior surface of the sclerotic at some distance from the cornea (behind the

wedge) and a second cut forwards (figs. 19 & 20 *b*) from the lower part of the vertical incision, to reach the anterior surface of the sclerotic immediately above the cornea.

The pupil must be well contracted by eserine if possible, and adrenaline instillation is advisable, at least in congestive glaucoma. The cornea requires to be moistened during the operation.

(1). Puncture (diagrams represent left eye and ignore the conjunctiva) :—engage point of knife in conjunctiva 2 mm. or less above cornea, and push it down in a fold to corneal margin (fig. 21).

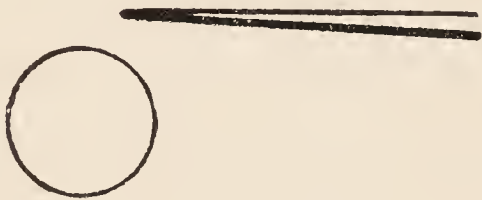


FIG. 21.



FIG. 22.

Scleral puncture close to cornea ; knife edge upwards and perhaps a little backwards ; knife directed nearly transversely, only very little downwards (fig. 22).

Blade free in anterior chamber for 3—4 mm. only (fig. 23).



FIG. 23.

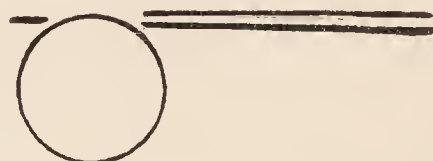


FIG. 24.

(2). Then the point is brought forward and upward to counterpuncture, with blade transverse, and point emerging through sclerotic just above cornea. A slight localised prominence usually shows the position of the knife before it actually comes through and so allows of any necessary correction in the location of the counterpuncture (fig. 24).

(3). Twist the blade as soon as the point comes through the sclerotic to allow a little aqueous to leak out under the conjunctiva. This balloons up the conjunctiva about the puncture and counterpuncture and so protects it against section with the knife. But this is not essential, and if much aqueous is thus allowed to escape under the conjunctiva, the cutting of the sclero-corneal wedge later is not clearly seen.

(4). Turn cutting edge of knife downward, and thrust the knife onwards. Cut a little downwards till



FIG. 25.

nearly the whole breadth of the blade is visible in the anterior chamber. (The edge of the knife must be tilted momentarily forward to reflect the light from the blade up

to the operator's eye for the blade to be seen well) (fig. 25).

(5). Turn cutting edge upwards and somewhat backwards and extend the incision up into the sclerotic. (Shown too high in diagram) (fig. 26).



FIG. 26.

(6). Move the blade down again and turn its edge forwards and cut forwards (and slightly upwards) perpendicular to the surface, thus



FIG. 27.

defining the lower boundary of the wedge. The centre of the line should almost touch the margin of the cornea. Cut with slow gentle sawing movements without any pres-

sure, and so slowly reach the scleral surface without dividing the overlying conjunctiva (fig. 27). There is no difficulty in thus saving the conjunctival covering if the knife be lightly held and if all hurry is avoided.

(7). The upper limit of the wedge has still to be defined, *i.e.*, the bridge of superficial sclerotic left above has to be cut through. The blade is passed up behind the

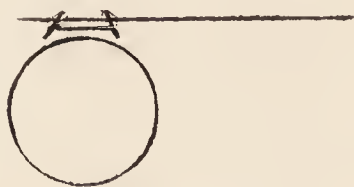


FIG. 28.

partly isolated strip of sclerotic, and the edge again turned forward, to cut through to the scleral surface less than a millimetre above the lower border of the wedge, already defined. Here it is easier to avoid cutting through the conjunctiva (fig. 28).

(8). The knife cuts up under the conjunctiva, as if to cut a long conjunctival flap. But the conjunctival flap is not completely outlined. A narrow bridge of conjunctiva is left undivided above, preferably towards one or other side (fig. 29).

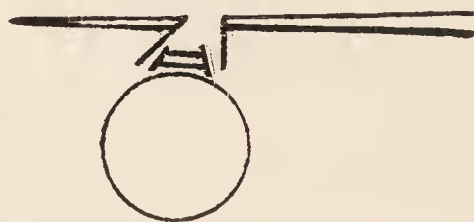


FIG. 29.

The operation is now complete except that it appears advisable to make a minute basal "button-hole" iridec-tomy to permit of the direct passage of aqueous from the posterior chamber, and so prevent adhesion of the iris to the line of the wound (fig. 30).



FIG. 30.

This can be easily done by passing the iris forceps in behind the conjunctiva and behind the isolated wedge of tissue. But if the iris be narrow and atrophic, a "button-hole" will be found impracticable, and a complete, but not necessarily wide, iridec-tomy must be done.

CHAPTER V.

OPERATIONS ON THE LENS.

INDICATIONS FOR OPERATION AND SOME OTHER CONSIDERATIONS.

Indications for Operation.

THE indications for operation upon the lens are general or special. *General* indications are concerned with the health of the patient and have been dealt with in Chapter I. *Special* indications depend upon the nature of the cataract, its ripeness, etc. These may be considered in classes according as the cataract is complete or partial.

A. PARTIAL CATARACTS.—1. *Anterior capsular (polar) cataract* is best left alone. If vision is interfered with, and dilatation of the pupil improves it, an iridectomy is indicated.

2. *Posterior capsular (polar) cataract* should be left alone.

3. *Anterior and posterior cortical (lenticular) cataracts* should be left alone. They are nearly always associated with lesions of the fundus.

4. *Lamellar or zonular cataract* may be stationary or progressive. If stationary and sight is improved by atropine, *i.e.*, if there is enough clear cortex for clear vision, an iridectomy should be done downwards and inwards. Vision is likely to be better when the coloboma is in this direction as the visual axis cuts the cornea to the inner side of its centre. Should an extraction subsequently be necessary the coloboma can be used by

making the corneal section downwards. If progressive, or if vision is not improved by atropine, *i.e.*, if there is insufficient clear cortex, the cataract should be removed. Under thirty years of age this may be done by discission, over that age by extraction. A preliminary needling may be done and then when the whole lens becomes opaque and swells it may be extracted, seven or eight days later with irrigation. (See Linear Extraction, p. 63).

B. COMPLETE CATARACTS.—*Congenital and juvenile* cataracts differ from lamellar in involving the whole lens. They are bilateral and generally white and uniform in appearance. The anterior chamber is usually deep and the lens often tremulous. Disease of the deeper parts is not uncommon. This and want of development of the retina from delay in having the cataract removed often render operation unsatisfactory in its results as regards vision. Fluid vitreous often prolapses. Sometimes it will be found that no lens exists, merely tough anterior and posterior opaque capsule being in contact without any lens between, or with some milky matter only. This is known as a membranous cataract. These cataracts run in families, three and four children being sometimes found blind from them in the same family. Such children are often defective in other developmental respects. Such cataracts are generally too tough to be treated by discission. They may then be extracted through small corneal sections. There is considerable risk of iritis, however, as posterior synechiæ are common. Hæmorrhage nearly always occurs freely from tearing of these adhesions.

Traumatic cataract results when the capsule of the lens is damaged. It may also very rarely result from concussion without any perforating injury. The case should be treated at first by iced compresses and atropine

provided enucleation is not demanded by the presence of a foreign body, or by the severity of the injury. If the injury occurs in a young subject the cataract will be soft. If after 30 years of age the nucleus is hard and absorption is not likely to take place. When the lens swells up it should be extracted with iridectomy if the tension is increased as it generally soon is in elderly subjects. If the increase of tension occurs in a young subject it may be relieved by paracentesis or by iridectomy without extraction, and absorption go on all the quicker for the operation. Where absorption comes to a standstill extraction combined with irrigation is indicated (see Linear Extraction, p. 63). Dionine applied with atropine hastens the absorption of lens matter.

‘*Senile*’ cataract.—This which is by far the commonest form met with is found not only in old people but at comparatively early ages. This is especially the case in India where most people age five to ten years earlier than in temperate climes, and where such cataracts are not uncommonly met with in persons aged thirty and thirty-five. In a considerable number of patients a family history of cataract is forthcoming (about 24 p. c.*) and in the later generations it tends to appear at a younger age.

‘*Senile*’ cataracts more commonly begin in the nucleus in India and gradually involve the whole lens. Sometimes—oftener in Europe apparently—they begin in the cortex, and then they may ripen more slowly. They always contain a hard nucleus as the nucleus scleroses about thirty years of age, but the cortex varies in consistence and amount. When a cataract is maturing it swells and

* Analysis of one thousand consecutive cataract extractions. By F. P. Maynard. *Indian Medical Gazette*, Vol. XXXVIII, 1903.

makes the anterior chamber shallow. During this period the lens is a bluish white colour and shows clearly lustrous stellate markings. When ripe this swelling subsides, vision of all but light and moving objects is abolished, and the opacity reaches to the capsule so that no shadow is cast by the iris in oblique illumination of the pupil and no fundus reflex can be seen. The lens has now lost its lustre and is of a dull grey or brownish colour. When over-ripe the cortex either becomes liquid and the small nucleus sinks to the bottom of the capsule (Morgagnian cataract), or the cortex becomes cheesy and the whole lens shrinks. In either case the lens becomes of a white uniform colour, and eventually white 'plaques' form on the anterior capsule. The lens becomes tremulous from stretching and atrophy of the zonule of Zinn and subluxation may occur. Our aim should be to remove the lens when the cortex has just begun to become liquid, before the capsule has become tough if we are going to extract. The indications for removal in capsule are given later. The capsule then has a uniform milky white appearance, having lost the radiating glistening sectors it showed at an earlier stage. No cataract of any kind should ever be operated upon unless the eye has good perception of light and good projection of light as well. This can only be ascertained by an ophthalmoscopic examination in a dark room. The reasons for and against iridectomy and other special precautions will be discussed later under the heading of "accidents and complications," but a general and rather dogmatic statement of indications may be made here.

In unripe cataracts a preliminary iridectomy performed some weeks beforehand is recommended by many eminent surgeons. It is very rarely possible in India.

If operation is required on the grounds of loss of employment, very slow maturation, etc., then express* in capsule with iridectomy, or extract with iridectomy, coaxing out or irrigating as much unripe cortex as possible. Discission will very likely be required later on after extraction to obtain clear vision.

In ripe uncomplicated cataracts with promptly reacting pupils perform extraction with, or occasionally without, iridectomy (*v. infra*).

In over-ripe cataracts express in the capsule with iridectomy.

The reasons for recommending expression in capsule in unripe lenses is that in them the capsule is firm and does not readily rupture. The lens comes out fairly easily and there is no after-cataract. Extraction of unripe lenses is unsatisfactory because much clear cortex is left, even after thorough irrigation, and necessitates discission once or oftener before good sight is obtained. The risks of expression are worth running to avoid such disadvantages. In over-ripe lenses, on the other hand, the capsule is tough and readily separates while it less often ruptures. When it does rupture, as it is made to by the capsulotomy in extraction, thickened capsule, and degenerating and irritating cortex are likely to be left behind. Expression in the capsule is therefore *the* operation for over-ripe lenses. (cf. p. 107).

If during the course of simple extraction the iris shows a tendency to prolapse and the pupil does not become round and central on its being replaced, an iridectomy should be performed. Should the lens refuse

* By *expression* is meant the squeezing out of a lens in its capsule (Smith's Operation). By *extraction* removal of a lens after opening its capsule, the capsule or most of it being left behind.

to be delivered because of its size or adhesions not previously diagnosed, or because the iris contracts and prevents it, an iridectomy is also necessary.

‘*Black*’ cataracts are large and complete and of a dark brown glistening colour. They result from a total sclerosis of the lens and contain a black pigment that stains objects they touch. They are large and hard throughout without any liquid cortex and require large sections and iridectomy for their removal. They are generally met with in old subjects. Such cases generally do very well.

Cataract due to general disease and poisons.—Cataract is met with in diabetes, epilepsy, nephritis, after convulsions, poisoning by naphthalin, ergot, in pellagra, and after electric shocks. The indications for operation depend more upon the local conditions found in the eye than upon the general condition. Extraction in diabetes, albuminuria (without dropsy), and chronic malaria are as successful generally as in healthy subjects. If there is diabetes the sugar is to be reduced by appropriate dieting and treatment before operation is performed.

The state of vision in the other eye.—If there is a ripe cataract in one eye and the other eye has good sight should the cataract be extracted? The answer to this question depends upon the duration and degree of maturity of the cataract as well as partly upon the occupation and habits of the patient. If the cataract shows signs of hyper-maturity when first seen, such as white dots on the anterior capsule, tremor of lens or iris, it had better be extracted. If it be ripe the question is more difficult to answer. Operation results in a marked degree of anisometropia which glasses will not overcome. On the other hand the field of vision is enlarged and this

is a distinct advantage, especially in certain occupations, *e.g.*, in workers among machinery, etc. Moreover, there is then no danger of the retina losing its sensibility. This does not occur generally until signs of hypermaturity have long been present however, and before that time extraction will probably have been decided upon, so loss of functional activity is not a very real danger. If the patient is a sensible man who will have his eye examined at regular intervals it is better to defer the extraction until the sight of the second eye becomes unequal to the necessities of his occupation. It is important that the eye should be so examined as glaucoma may develop and require immediate operation. This is of course all the more important if atropine is used regularly during maturation, as it sometimes is in nuclear cataracts because it improves vision.

Myopia.—The rules regarding removal of the lens in high degrees of myopia are fairly crystallised now. It should not as a rule be done in any but young adults 20 to 30 years of age with myopia of not lower degree than 20 D. Faulty vitreous, as predisposing to detachment of the retina, tendency to intra-ocular hæmorrhage, and lowered tension contra-indicate it. The worse eye should be operated upon, leaving the better eye alone for near vision. Repeated discission is the best operation. In those in whom the nucleus has become sclerosed, needling, followed a week later, or at once on any increase of tension occurring, by extraction, is done. Expression in the capsule should never be attempted. The diminution in the myopia is far greater than would be expected,—up to 25 D. in some cases, so that convex glasses may be required. The retinal images may be increased to two and a half times the size of those in the corrected eye

before operation. The improvement in vision is from four to ten-fold. The tendency to detachment of the retina appears to be slightly increased by the operation, but this point is very difficult to decide as the worse eye is generally operated upon.

Complicated Cataracts.

Complicated cataracts are those in which the eye is not normal apart from the development of cataract in it.

Leucoma does not affect the operation unless there are anterior synechiæ. It then renders an iridectomy necessary and of course its situation regulates the direction of the section. This is best made on the side of the cornea farthest away from the leucoma.

Arcus senilis does not interfere with healing. The resulting cicatrix is concealed by it and is more difficult to recognize.

Antecedent iritis forms an important complication. If the synechiæ left are few, ordinary extraction with iridectomy will suffice. If they are more numerous and dense so that the pupil is occluded or excluded by them a modified operation will be required. The knife should be passed through the cornea iris and capsule and out again so as to divide all these structures in the section. (Wenzel's operation). A large piece of the iris and capsule are then cut out with scissors and the lens extracted. Hæmorrhage is frequent from the unhealthy iris vessels and iritis often follows. Moderately good results, however, are met with, and in case the pupil closes up a subsequent section of the iris and capsule with de Wecker's scissors after the parts have quieted down may obtain fair vision.

Dislocation of a cataractous lens may occur when it is hypermature. As it shrinks it draws upon the suspen-

sory ligament and causes it to atrophy. A slight shake of the eye, as in taking a false step, sneezing, etc., then suffices to dislocate the lens. It may pass forward into the anterior chamber where it causes trouble by setting up glaucoma, iritis and opacity of the cornea. It should be removed as soon as possible. If the lens passes backwards into the vitreous less injury results, though here irido-cyclitis may ensue from gradual pressure on the uvea, or glaucoma, or blindness from pressure on the retina. Lenses dislocated into the vitreous are also met with as the result of the cataract-prickers' performances. If seen within a few days after being 'couched' the lens may be extracted by means of the vectis with loss of vitreous. If not seen until the lens has become fixed and the eye quiet, it is better left alone as the adhesions will probably render extraction impossible, and the last state of the eye will be worse than the first if it be touched.

Glaucoma may come on in a cataractous eye (*glaucoma in oculo cataractoso*) with the usual signs of glaucoma in addition to those of cataract previously present. Iridectomy should be at once done under chloroform, and if the lens is ripe, or, even if not, if it presents in the wound, it should be extracted. Such cases do well if seen early. Every day, every hour indeed, passed before operation, makes the prognosis worse.

Cataract may come on in a glaucomatous eye (*cataracta in oculo glaucomatoso*). Here the signs of chronic glaucoma have been present first and if the disease is not advanced some vision will be present. A large iridectomy should be performed and the cataract extracted some weeks later. The opacity is a degeneration

resulting from the high tension and of course any operation done to remove the lens while the glaucoma persists can only result in disappointment and serious trouble to the patient. Intra-ocular hæmorrhage is almost certain to follow and even if the patient escapes this he cannot possibly obtain any improvement of vision from the extraction of the lens. In the later stages, the eye is blind, but blind from the atrophy of the nerve head and not from the cataract. The latter is rarely complete and a red fundus reflex can nearly always except in the latest stages be obtained round its margin.

Diminution of tension (hypotony) is not infrequently met with. It may be due to general diseases such as plague after which the tension sometimes remains low for a time. It is remarkably reduced in plague cases where irido-cyclitis has occurred as it not infrequently does.* The use of a bandage such as is often applied for twenty-four hours before operation reduces tension, as does cocaine. At times tension is found reduced without apparent cause and such cases do well after extraction. More often a reduction of tension indicates some deep-seated disease such as detached retina or irido-cyclitis and it is then an absolute contra-indication to operation.

* Some Ophthalmic Complications of Plague. By F. P. Maynard. *Indian Medical Gazette*, Vol. XXXV, 1901.

CHAPTER VI.

OPERATIONS ON THE LENS—(*Continued.*)

OPERATIONS :—DISCISSION—LINEAR EXTRACTION— EXTRACTION WITH IRIDECTOMY.

Discission.

Indications.—Discission is suitable for congenital and juvenile cataracts involving the whole lens, when they are not membranous ; for zonular cataracts that are progressive ; for traumatic cataracts before the age when there is a sclerosed nucleus ; and for removal of the lens in high myopia. In all these cases the process may be accelerated by performing a linear extraction (*q.v.*) as soon as the lens has become swollen up and cloudy.

Instruments.—Clark's speculum (fig. 8), fixation forceps (fig. 9), a cataract needle (fig. 31).

Anæsthesia, in adults, local ; in children, if without control, general anæsthesia is required.

Method.—The eye is prepared in the same way as for cataract, and atropine instilled. The surgeon and patient are placed as in cataract extraction. The speculum is inserted and the globe held by fixation forceps applied to the inner side of the conjunctiva below the cornea. The needle is entered external to the limbus and is passed through the sclero-cornea at three o'clock R. E., (at nine o'clock



FIG. 31.—Cataract needle.

in the L. E.), and pushed on parallel to the plane of the iris until the point is in the centre of the pupil. The handle is then raised slightly and rotated, so that the point enters the lens through its anterior capsule. The point is then made to cut the capsule freely in different directions, using the puncture in the sclero-cornea as the centre of rotation, until the capsule and the anterior portion of the cortex are well opened to the action of the aqueous. Before withdrawing the needle it must be rotated so that the plane of the blade is again parallel to the iris, otherwise the puncture will be enlarged in the withdrawal and the aqueous escape through it. Such free needling is not desirable in discission for myopia.

After a few weeks absorption of the lens comes to a standstill and the needling has to be repeated. It may have to be repeated several times before the pupil becomes clear black.

Accidents.—Dislocation of the lens may occur if the capsule is very tough, or the zonule very thin and weak, or if the operator's hand is heavy. Extraction is required if it happens. The lens may swell up and push the iris forwards, setting up increased tension with ciliary injection and pain. This is more likely the older the patient and the freer the discission has been. Evacuation of the swollen lens fibres is necessary and is generally done at once by linear extraction. Infection may occur but is less likely when the operation is performed sub-conjunctivally as here recommended, than when the needles are passed in through clear cornea. Sympathetic ophthalmitis has followed the operation, but there was first of all iridocyclitis in the needled eye, probably due to infection.

After-treatment.—Atropine is instilled and both eyes bandaged. In a child the arms are tied on splints for

twenty-four hours. Atropine is instilled daily while absorption is going on, any sign of increased tension being carefully looked for.

Linear Extraction.

Indications.—The operation is required for traumatic cataract with soft nucleus; after discission (for the indications for this, see p. 53), when there is increase of tension from swelling of the lens, or where absorption of the lens matter is very slow.

Instruments.—Clark's speculum (fig. 8), fixation forceps (fig. 9), angular keratome (fig. 12), iris forceps and scissors (figs. 10, 15 and 38), cystitome and curette (fig. 39), spatula (fig. 14), McKeown's irrigation apparatus (fig. 33).

Anæsthesia.—Local, except in children for whom chloroform will be necessary.

Method.—After the use of atropine, cleansing of the

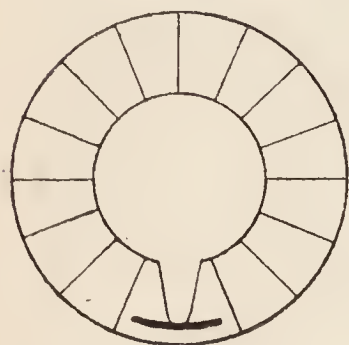


FIG. 32.—Diagram of incision in linear extraction. Small iridectomy shown.

eye and cocainisation, the speculum is inserted, and the surgeon standing at the patient's head fixes the eye with fixation forceps applied to the conjunctiva at the inner and lower side of the cornea. The point of the keratome is passed through the clear cornea at six o'clock (above, that is), just internal to the apparent sclero-corneal junction (fig. 32). The apex must be directed

towards the centre of the eyeball until it appears in the anterior chamber, when the handle is at once lowered until the plane of the knife is parallel to the plane of the iris. The knife is then pushed on until the wound is a quarter of an inch long, when it is withdrawn. This

must be done slowly to allow the aqueous to escape very gradually. During withdrawal the wound can be enlarged toward either corner, if desired. If the lens capsule is not open the cystitome should be used to open it freely. The soft lens matter is then evacuated by introducing the curette just within the wound, and making slight pressure with it against the under-lip of the wound,

when if quite soft the lens matter will escape along the instrument, being helped to do so by counter-pressure with

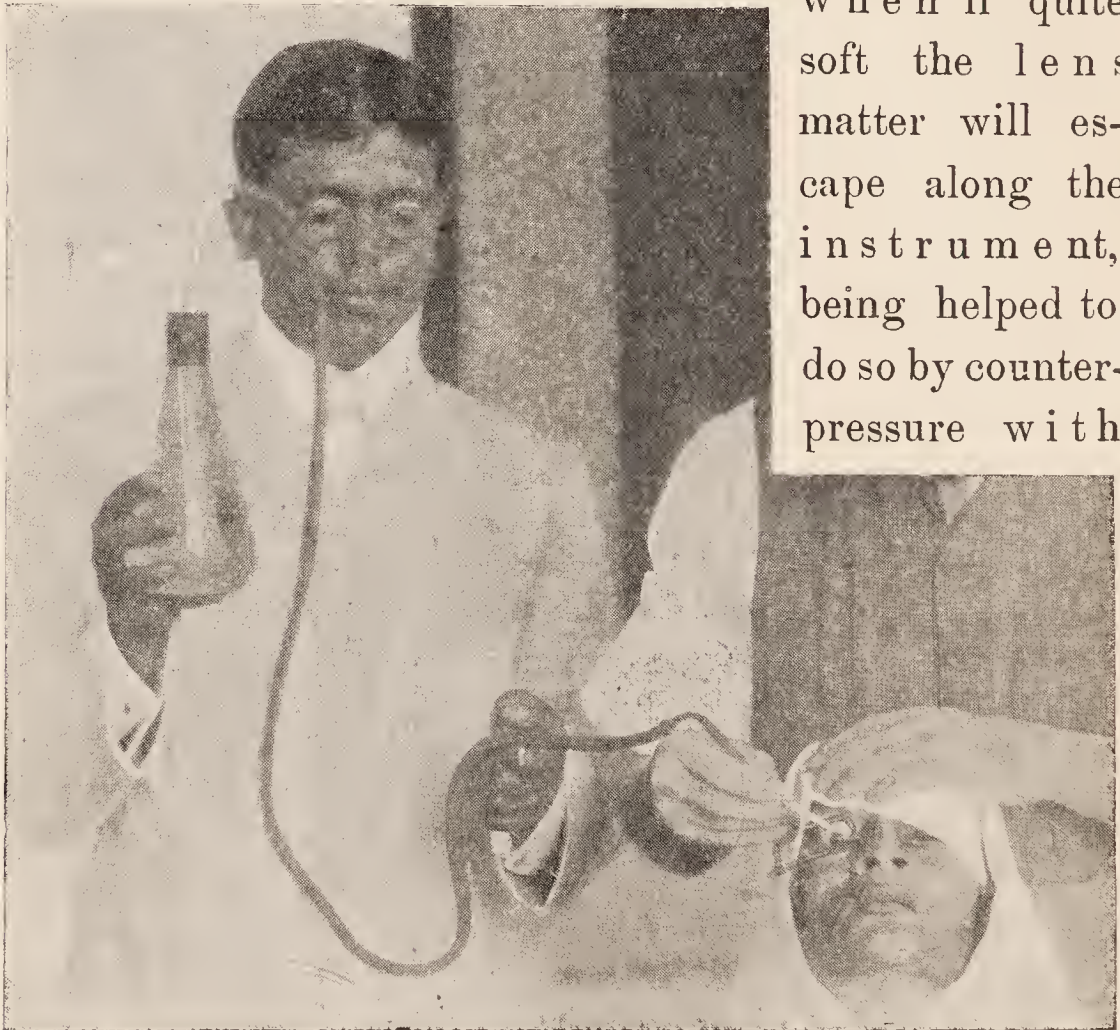


FIG. 33.—Irrigation of the Anterior Chamber.

the fixation forceps or a spoon. If like boiled-sago, however, as the lens matter sometimes is, the irrigator should be used to remove it.

Irrigation of the Anterior Chamber is performed as follows:—(Figure 33). The conical flask is filled with sterilised normal saline solution (gr. iv to 3j.), and is provided with a bent tube to which the rubber tube

for the irrigation nozzle is attached, and a second bent tube with glass bulb on it, filled with wool, for the syphon-action to be started by blowing through it, preferably by a small rubber bag. About a foot from the nozzle a spring clip is placed on the rubber tube. It is convenient to have a half-inch tube leading from the flask to just beyond the clip, and a smaller tube inserted in the end of it to hold the nozzle. The tubes are cleaned by soaking in 1 in 5000 mercuric iodide lotion, which is thoroughly washed out with saline before use. The end is to be kept under lotion in a tray until the tube is needed. The nozzle is boiled with the other instruments and kept with them in the china tray until wanted. The narrow rather pointed nozzle is the best of McKeown's patterns. The assistant in charge of the apparatus, after starting the syphon action, stands to the operator's right, holding the flask in his right hand and the spring clip in his left, the loose end of the smaller rubber tube for the nozzle hanging free and not being allowed to touch anything. When wanted, he raises his left hand in the air near the operator, who takes hold of the tube and fixes it on to the irrigation nozzle. The assistant raises his right hand holding the flask and presses the clip, and the saline at once runs through the nozzle, driving out the air in it. The surgeon holds the nozzle between the thumb and index finger of the right hand, and by compressing the rubber tube on the flat portion of it he has complete control of the stream, provided the assistant continues to compress the clip as he ought to do until told to stop. It is better for the surgeon to control the force of the stream in this way himself, rather than to make the assistant do it by raising or lowering the flask. Holding the nozzle exactly like a pen, the tip of it is brought near

the operation wound *from the side*, and the pressure of the thumb and finger slightly relaxed. The fluid flows and passes between the lips of the wound and into the anterior chamber. If the cortex is very fluid this will suffice to wash it all out, especially if the peripheral lip of the wound be depressed slightly with the nozzle. If the cortex is more consistent it will be necessary to introduce the nozzle further, and even in some cases to make it enter well into the anterior chamber. Directing the stream in a little obliquely will make the current circulate and wash out cortex better.

The stream should be directed behind the lower edge of the pupil when the nozzle is in the anterior chamber. If irrigation is prolonged the muscles of the iris seem to lose their power, and prolapsed iris, when replaced with the spatula, tends to again prolapse. Short of this irrigation appears to stimulate the iris, and the pillars of the coloboma are easily washed out of the angles of the wound into place by directing the stream towards them.

It is possible to claim too much for irrigation. In cases of soft flocculent cortex which is easily stroked out it is unnecessary. In transparent and glutinous cortex, common in unripe lenses, it will not wash nearly all out, but even so it is a great improvement on extraction without irrigation. When in such cases the cortex left behind swells up, its absorption goes on more slowly than if irrigation had not been employed. The composition or circulation of aqueous seems to be altered in some way, and cortical matter is less easily disposed of. Twenty-four hours after an extraction with irrigation the anterior chamber sometimes looks as if filled with commencing lymph. This all clears up by the second or third day,

but it is alarming until one gets used to it. The risk of upward movement of the eye driving the nozzle deeply into the globe and causing prolapse of vitreous, etc., is avoided by holding the nozzle obliquely and introducing it, if introduction is required, obliquely from one corner of the wound. If the nozzle is held at right angles to the centre of the wound and the patient looks up suddenly danger arises at once. Playing on the surface of the wound for a second or two is useful, as pointed out by Major Elliott, I.M.S.,* in cleaning the wound surface so that nothing infecting is likely to be carried into the chamber, and in reassuring the patient that nothing dreadful is going to happen. Rubber bags have been adapted to McKeown's nozzles by Dr. Wanless,† but the author agrees with Major Elliott in preferring the use of a conical flask, which is more easily sterilised. As regards control, nothing could be better than the control exercised in the manner above described, by pressure on the rubber tube to which the silver nozzle is fixed.

The disappearance of the so-called 'Descemitis' and the absorption of cortex are accelerated by the use of dionine (gr. x to ʒj) applied twice daily.

Accidents.—Iris may prolapse in linear extraction. It should be replaced with the spatula, but if it will not remain, a piece of it must be excised, and the pillars of the coloboma carefully replaced, to prevent subsequent incarceration. It is for this reason, *viz.*, that an iridectomy may become necessary, that the corneal section is made above. Vitreous may prolapse, if the zonule of Zinn gives way, or if the posterior capsule is divided, and care should be taken throughout to avoid this, if possible.

* *Indian Medical Gazette*, Vol. XXXVII, 1903, p. 124.

† *Indian Medical Gazette*, Vol. XLI, 1906, p. 123.

It increases the danger of infection with consequent iritis, irido-cyclitis, and possibly sympathetic ophthalmitis.

After-treatment.—As after extraction (*p.* 77).

Extraction with Iridectomy.

Indications.—These have already been discussed on page 51.

Instruments.—Clark's speculum (fig. 8), fixation forceps (fig. 9), Graefe's knife (fig. 35), iris forceps (fig. 10), Maunoir's angular blunt-pointed scissors (fig. 38), cystitome and curette (fig. 39), double cataract spoon (fig. 40 or 41), Taylor's vectis (fig. 43), Desmarre's retractor (fig. 34), McKeown's irrigator and nozzles, (fig. 33), eye-guard (fig. 42).



FIG. 34.—Desmarre's Retractor.

Anæsthesia.—Three instillations, at five minutes intervals, of two drops of a five per cent. sterile solution of cocaine hydrochloride. The eyelids should be kept closed with a sterile pad resting on them to prevent drying of the corneal epithelium.

Method.—The face and eye being prepared in the manner described in Chapters I and II, and the eye being atropinised and cocainised, the patient is laid on the operation table with the eye to be operated upon in the best light available. A single uniform north light is best, and the reflections of many windows on the cornea is to be avoided. The head is slightly raised on a firm pillow and need not be held unless the patient desires it. A sterilised towel with an oval opening in it, through which the operation can be performed, is laid across the face.

This stops the patient looking about him, or being frightened at the sight of the instruments if the other eye has vision, and prevents soiling of the hands of the operator.

Clark's speculum (fig. 8), is inserted and fixed by its screw at just less than the maximum opening permitted by the lids (Plate I). This saves the patient some suffering, and the operator trouble, as otherwise the extreme tension causes the patient to screw up the eyelids. It should be seen that the outturned inner ends of the speculum are not pressing painfully into the skin of the lids. The conjunctival sac is flushed out again with sterilised saline solution ; mercurial lotion would corrode the speculum and is unnecessary at this stage. Moreover, should any mercurial lotion stay in the conjunctival sac and obtain access to the anterior chamber, opacity of Descemet's membrane might follow and be permanent.

The operator stands behind the patient's head and makes the section in the right eye with the right hand, in the left eye with the left hand. If he is not ambidextrous he must come round to the right side and face the patient to make the corneal section on the right eye with his right hand ; moving back to the patient's head for the remainder of the operation, as he can presumably use the left hand for the cystitome, even if not for the section. Getting the patient to look forwards and downwards the surgeon seizes the conjunctiva just below the usual seat of inner pterygium, at ten o'clock that is (fig. 16), with the fixation forceps, taking a good grip of it to lessen the likelihood of tearing it, and avoiding pressing or pulling upon the globe. If it begins to tear, as it may in old subjects, a firmer hold may be obtained by slightly rotating the fixation forceps after seizing it. The

knife (Graefe's fig. 35), held lightly in the way a spoon is held in eating soup, edge upwards, is then made to puncture the cornea just anterior to the limbus and at a point one to two mm. above the outer end of the maximum transverse diameter of the cornea (Plate I). A slight elevation of its handle suffices to prevent the point passing between the layers of the cornea and to make it appear in the anterior chamber. The knife is pushed steadily on without stopping across the chamber, and the counter-puncture made at a corresponding point on the inner side of the cornea. The conjunctiva sometimes, especially if unusually lax, may at this stage be folded over the cornea by the traction of the fixation forceps pulling against the pushing knife, especially if the latter's point is not in absolutely perfect condition. If the forceps be stopped from so pulling, the conjunctival fold will usually fall back into its place and the counter-puncture may be made without further difficulty. The incision here described is necessary for a large lens. If the cataract be Morgagnian a smaller one will be enough.

With a large cornea it may be smaller, and with a small cornea larger relatively, as the lens may be and generally is large with quite a small cornea. Too large is better than too small an incision. So far the knife has been pushed on continuously and no cutting has been done. As soon as the knife point appears in the air through the counter-puncture however, the hand controlling it should at once begin to make it cut the section as well. It is important to keep the knife in the same plane parallel to the iritic attachment all the time.



FIG. 35.—Graefe's knife.

i.e., not to raise or lower the handle and so the point, and not to rotate the knife on its flat edge at all either. If any of these mistakes be made the aqueous escapes too easily and complications (*v. infra*) arise. Great care must be taken not to make the counter-puncture too deep. If this is done, the point takes up conjunctiva and the inner half of the incision becomes much too deep and difficult. The knife cutting upwards all the time is then pushed on

nearly as far as it will go. This is usually limited by the point approaching the nose, though in deep set eyes and those with small palpebral fissures a much shorter excursion only may be possible. Pricking of the inner canthus or side of the nose must be avoided, as it causes the patient to flinch and screw up his eye and may lead to vitreous prolapse.

The knife is then drawn away from the nose, still cutting upwards. As soon as about a mm. of the cornea remains undivided, the knife's



FIG. 36.—The dotted line shows in profile the position of the incision in cataract extraction with conjunctival flap.

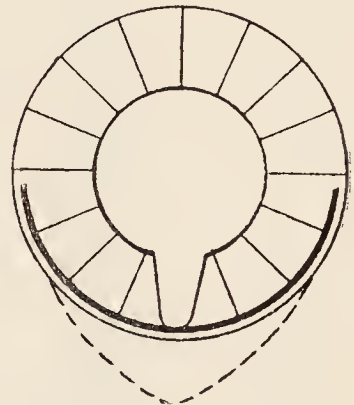


FIG. 37.—Diagram of incision with conjunctival flap, and iridectomy, in extraction.

edge is turned more towards the globe and the section is carried on parallel to the globe surface (figs. 36 & 37), thus taking up a conjunctival flap of varying size. Its size and the ease with which it is made depend on the laxity of the conjunctiva. If lax, it is easily made, the knife edge may indeed have to be turned forwards and not backwards in such cases, while if thin, and firmly

adherent to the sclera, it is made with difficulty or may be impossible. The knife edge is, of course, turned forwards and cut out as soon as a large enough flap has

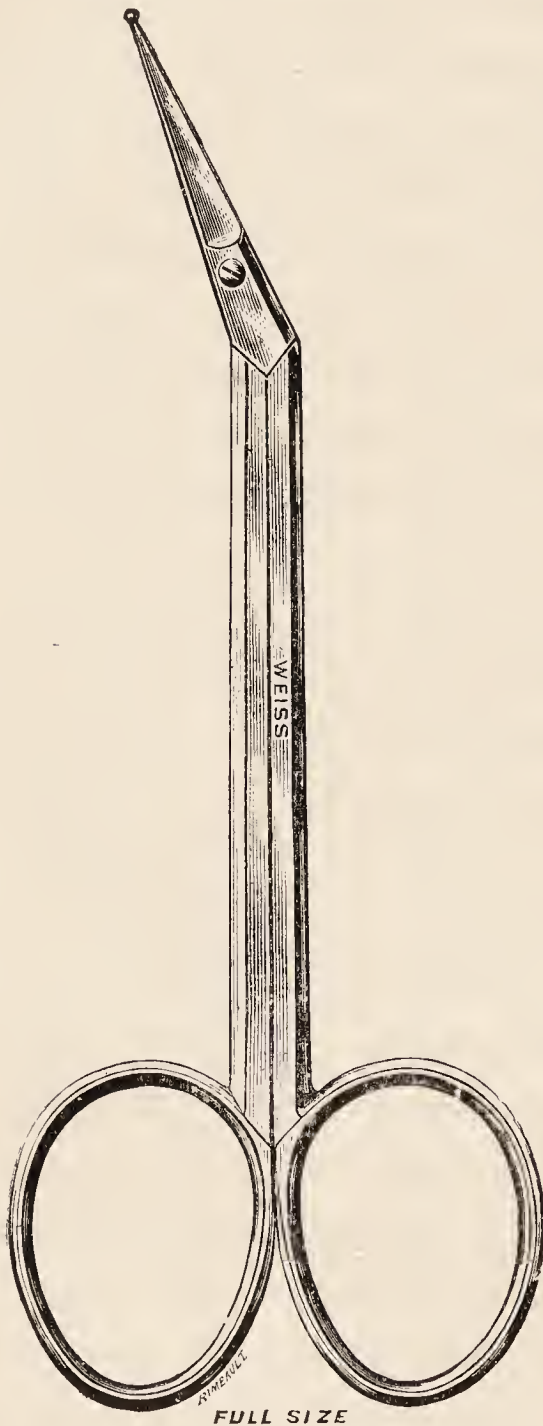


FIG. 38.—Maunoir's iris scissors.

been fashioned. Very large flaps are unnecessary and give trouble by bleeding. Unless the patient looks down well at this stage, it is sometimes difficult to make the flap in deep-set eyes without blunting some part of the edge of the knife against the speculum. The flap is quite easily made if the patient looks as directed.* The flap is turned up by the knife on completion of the section, so as to lie on its back on the cornea. While the incision is thus being made, care must be taken not to press unduly upon the globe with the fixation forceps, or the completion of the section may at once be followed by vitreous prolapse. Pulling on the fixation forceps on the other hand tears the conjunctiva. The

iris forceps (fig. 10) are next taken in the left hand, their closed points passed into the anterior chamber, and the iris seized at its pupillary margin, after opening them only just enough to grasp the iris.

* Patients, unless very stupid, can easily be trained to look up or down as required.

The angular iris scissors (fig. 38) are at the same time held by the right hand just over the wound slightly open, with the thumb and middle fingers in the rings and the index steadying the shaft, and with the cutting part at right angles to the line of incision (Plate II). This makes a narrow coloboma, which is all that is required. Should any blood show along the line of incision the scissor blades may be passed lightly along to wipe it away before the insertion of the iris forceps. As soon as the iris forceps reappear holding the iris, the scissors are at once closed cutting off a small piece of iris, which includes the sphincter and a strip extending a little over half way to the ciliary margin of the iris. If the scissors are not ready the patient may move as the iris is not always rendered insensitive by cocaine, and the iris be torn or a much larger piece cut than is necessary. With a reasonably well-behaved patient it is not necessary to have the globe held by an assistant with fixation forceps while performing iridectomy.

The lens capsule is next opened. A sharp-pointed cystitome (Graefe's, fig. 39) is passed into the anterior chamber near the centre of the incision, so as to avoid catching in the iris, with its sharp point lying horizontally and entering last, as far as the lower border of the pupil. The point is then turned towards the lens and the capsule is torn by slight pressure and gentle movement of it along the lower margin of the pupil. Begin lacerating the capsule low down, and then if the lens does not immediately present, as it sometimes does, complete the

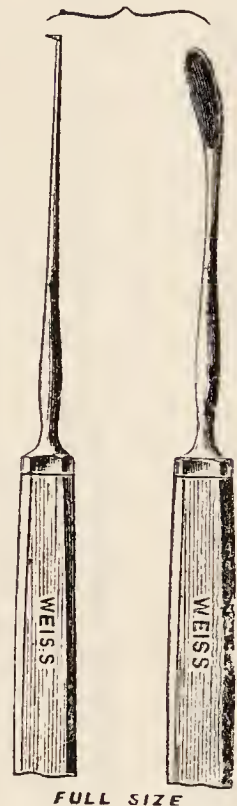


FIG. 39.—Cystitome and Curette.

tearing of the capsule all round in a circle as large as the pupil will allow, so that as much anterior capsule as possible may be removed from the eye with the lens. The point of the cystitomes usually supplied is far too long, and instead of cutting the capsule it sticks in it and drags the lens about. If the capsule is found to be so tough that it is impossible to lacerate it, and attempts to do so threaten dislocation of it into the vitreous,

the lens should be extracted in its capsule whole. The capsule having been opened, or the attempt to open it being abandoned, the cystitome is withdrawn very carefully and so that the blunt edge comes out first, and the extraction of the lens is proceeded with. The curette (fig. 39) is placed on the cornea just above its lower margin and pressed directly backwards, *i.e.*, not towards the centre of the eyeball, but towards the back of the orbit parallel to the visual axis.

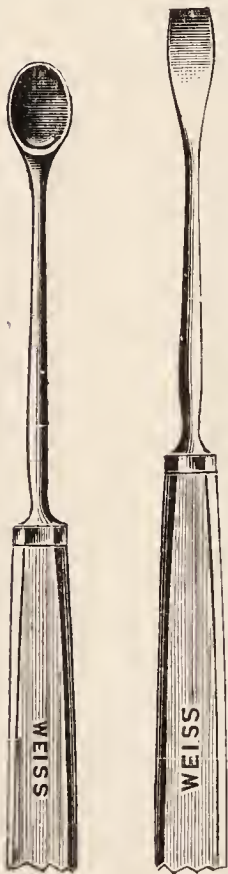


FIG. 40.—Bowman's double cataract spoon.



FIG. 41.—Macnamara's spoon.

This presses the lower edge of the lens backwards and tilts the upper edge forwards. To assist the latter to escape from the wound, it is well to make gentle backward pressure on the sclerotic just above the incision with a cataract spoon (fig. 40 or 41) and at the same time to slide the curette from below up, still pressing backward, over the cornea, pushing the lens before it and out of the wound. Care should be taken to see that the curette is made to moisten the cornea, if dry, with

tears moved up from the lower part of the sac, otherwise the epithelium softened by the cocaine may suffer damage. Stroking movements from below upward may be made by the curette to remove soft cortex or any blood left in the eye. Failing to do so, gentle irrigation may be performed with McKeown's apparatus (see p. 64). The author's practice is to use this if stroking does not bring out enough cortex to leave the pupil black. It is seldom advisable to pass any instrument into the anterior chamber to remove cortex or capsule left behind, but better to remove what is possible by stroking or irrigation, and to leave the rest to be absorbed as it generally is, or to be needled if necessary later on. The only exception to this is when tough capsule has been met with. Tough capsule, especially if calcareous, may be withdrawn by iris forceps passed into the anterior chamber. Such lenses are better expressed in their capsules, however (*v. infra*). The curette is next passed through the wound from each corner, stroking the pillars of the iris coloboma into place and removing any bits of capsule, and preventing their subsequent incarceration in the wound. This 'toilet of the wound' is very important and cannot be too carefully attended to.

The speculum is now removed, unless from bulging of the wound indicating danger of prolapse of vitreous it has been removed after the section. Should the patient try to screw up his eyes at any time during the operation, the assistant should take hold of the speculum near its joint, and gently raise it, so lifting the lids slightly away from the globe, taking care not to cause it to slip out.

Any blood and tears collected in the conjunctival sac are now wiped away with swabs of absorbent wool soaked in weak mercuric iodide lotion. Flushing out the sac at this stage is superfluous and may cause the patient to screw up

his eye and lose some vitreous. The flap is wiped into position, and after the instillation of atropine, the lids are closed. The rough testing of vision by making the patient count fingers may be desirable, but is better avoided, as while doing it the patient may open his eye wide and get the flap rubbed against his upper lid or even cause prolapse of vitreous. In closing the lids it is sometimes necessary to lift the upper lid off the globe by taking hold of the loose skin with the finger and thumb to prevent it pushing the flap out of place. A wet pad of gauze boiled in mercuric iodide (1 in 10000) is applied with a wool pad and roller bandage over it. One or both eyes may be bandaged. If one eye only is bandaged, in cases where the patient can see at all with the other, he is more likely to leave it alone and not lift up the bandage to try if he can see, thereby infecting the eye. The drawbacks are that unless the patient is quiet and well behaved, he will use the uncovered eye too much and so give the operated eye insufficient rest. Servants also take advantage of the patient having one usable eye and let him do far too much for himself. Bandaging one eye should be reserved for quite reasonable patients who will have good nursing. Its greater comfort is appreciated by them. The bandage is applied as a protection and to stop the movements of the lids, so slight pressure only is required. Where there is much conjunctival discharge which does not yield to treatment and which is markedly increased by any bandaging, it may be better to use no bandage, keeping the patient rigidly confined to bed. The method of applying the bandage is as follows. The surgeon, in the case of the left eye, holding the free end of the bandage in his right hand passes the roller obliquely across the left eye as far as the lobe of the left ear, and

thus fixes the pad firmly in position on the left eye. The assistant, who stands to the left of the patient, should now, and not before, pass the finger tips of his right hand in between the patient's occiput and the pillows and raise the head, keeping his left hand ready to press on the forehead, if necessary, and prevent the patient lifting his head too much or sitting up even as some will at once try to do. If the assistant lifts the head before the first fold of the bandage is in position, the patient may raise his head before he is under control and do harm. The bandage is then wound round the head over each eye and below

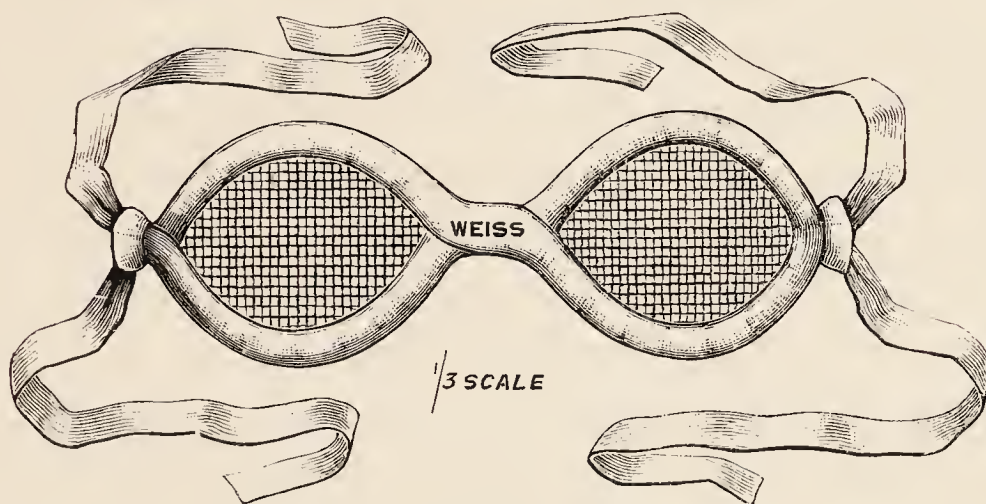


FIG. 42.—Pagenstecher's eye-guard.

each ear alternately, ending up with a turn round the head above the ears, and being then tied or pinned.

If the patient has not much control an eye-guard (Pagenstecher's, fig. 42) may be applied after being bent so as to fit properly.

After-treatment.—The patient is carried from the operating table to his bed (fig. 1). In restless patients a morphia draught may be given, though in them it is better given about an hour before the operation.

Any sudden pain coming on in the eye leads the house surgeon to open the eye, and if it is found to depend on prolapse of the iris, this is cut off. Otherwise

the bandage is not opened until the following morning when the eye is washed with warm mercuric iodide solution, atropine is instilled and the dressing reapplied. This is done daily, omitting the atropine after the third day unless complications arise. The method of dressing eyes that have been operated on for cataract is important. After removing the wool and gauze pads on each eye, from above downwards as already explained (p. 17), the lids of the unoperated eye should first be separated. They are generally stuck with secretion and the patient cannot help you in opening the other eye until this has been done. Moreover, if it be done gently he gains confidence and is less afraid of the other eye being touched. Next the lower lid of the operated eye should be drawn gently downwards, and the edge of a small cotton swab that has been flattened in squeezing the lotion out of it is passed along between the lids from the outer to the inner canthus. This wipes away mucus and two or three swabs are used until the lids are clean. Their outer surfaces are also wiped without any pressure being used, and wiping of the eyebrow in the direction of the hairs is refreshing to the patient. It is not advisable to squeeze a swab at any height above the eye to pour lotion in, or to use an undine. Either proceeding may make the patient screw up his eyes. Provided he is allowed at once to shut both lids, squeezing, however hard, does no harm. But if he squeezes his lids while one of them is held open there is unequal pressure on the globe, and opening of the wound and even prolapse is likely. If it is desired to inspect the line of incision the patient should be got to look downwards, and while doing so the upper lid may be gently raised, being let go immediately if any spasm of the

orbicularis comes on. To drop in atropine draw down the lower lid until the sac is seen and instil the drop. It is unnecessary to raise the upper lid for this. The conjunctival flap is united within twenty-four hours. The bandage may ordinarily be left off within a week and a green shade applied. The patient gets up if all is well after the third day. No solid food is allowed for three days to avoid mastication. The bowels having been well opened before operation, there is no need to trouble about them for two or three days. The vision gradually improves and does not reach its clearest for over a month after operation, until which time therefore it is better not to prescribe glasses. As the astigmatism which is present after extraction also changes considerably for a few months afterwards, the spectacle prescription may need further alteration to obtain the clearest vision possible.

Modifications.

Other modes of extraction.—Many surgeons obtain approximately similar results by diverse methods of operation. This may be explained by supposing that they modify their methods according to special requirements and complications met with, or that after all ‘all roads lead to Rome’ and, provided cleanliness be secured, modification of technique is of minor importance in influencing the final result, while the skill that comes from long practice is the one essential. These modifications refer to extraction only and do not include ‘expression’ and other distinct operations which will be separately dealt with. They may be considered under the following headings the advantages of each modification being briefly stated.

Fixing the Eye.—Instead of grasping the conjunctiva to the inner side and below at 10 o’clock, it may be seized

below at 12 o'clock. This enables one to draw the eye directly downwards in a stupid or nervous patient, but it is better to get the patient to look down voluntarily.

Incision.—Sclero-corneal incisions have been less and less often used since it was discovered that the less frequent suppuration met with after them was not due so much to the sclera being more vascular than the cornea, as was at one time supposed, as to the improvements introduced about the same time in asepsis and antiseptis. It is now known that it is perfectly safe to make a clean incision in the cornea up to nearly half its circumference, and, with a conjunctival flap, to even more were it necessary. Sclero-corneal incisions moreover besides requiring more skill have other disadvantages. They come so near the ciliary body that prolapse of vitreous is not rare, prolapse of iris or inclusion of it in the wound is common, with danger of subsequent iritis, iridocyclitis and sympathetic disease. Corneal sections, on the other hand, remove the wound well forward from the ciliary body and are accompanied by fewer prolapses of the iris. Being less linear and more flap-like they tend to gape more than scleral or sclero-corneal incisions and so render delivery of the lens easier.

Upward incision is generally performed unless some indication for downward incision, such as leucoma in the upper half, exists. The downward incision is easier and fixation forceps and speculum can be done without. Some operators still perform it though its drawbacks are greater exposure of the wound to infection, defective coaptation of the lips of the wound, the peripheral border being depressed by the lower lid, and a greater blurring of vision caused by an inferior coloboma when it is combined with an iridectomy.

Some operators always remove the speculum after completing the section. If there be any reason to fear loss of vitreous, *e.g.*, hypermaturity of the cataract, alteration in tension, etc., it is well to do so at this stage. Generally it may be left until the 'toilet' of the wound is completed.

Conjunctival Flap.—This is omitted by many and by others it is regarded as impossible of attainment with a corneal incision. So it is unless the knife is turned backward before completing the section. The objections to it are that when turned back on the cornea, as it has to be in order to be out of the way, it hides the view of the iridectomy, and that it often bleeds, sometimes into the anterior chamber, from which the blood is soon absorbed, however, in a healthy eye. It is, moreover, sometimes difficult to cut, especially in deep-set eyes and in eyes with thin and adherent conjunctivæ. It is easier to make when the eyeball is prominent and when the conjunctiva is lax. Its advantages are that by becoming united within twenty-four hours it closes the external edge of the wound from infection ; it thus also helps to save the wound from bursting open and the iris from prolapsing should the patient make any sudden exertion before the wound is fit to bear it. Suture of the conjunctival flap by fine silk is useful, but its usefulness is marred by the increased secretion and danger of infection caused by the irritation the suture sets up.

Iridectomy.—A preliminary iridectomy, performed four or more weeks before the extraction, is advocated by many continental surgeons. It is done to enable an unripe lens to be artificially matured by massage (Förster), or in cataracts complicated by posterior synechiæ, increase of tension, etc., or even in uncompli-

cated cataracts to hasten the ripening and to render the subsequent extraction easier and less dangerous. This latter it does by enabling us to see clearly the size and relations of the lens and the manipulations necessary for its removal, and by avoiding traumatism and prolapse of the iris. Patients in India so rarely submit to a second operation at the same hand when the first has as they think proved a failure, that these advantages are rarely obtainable.

Iridectomy performed at the time of extraction has advantages and drawbacks, and the advocacy of these may be said to have divided ophthalmic surgeons into two opposing camps for many years. It is noteworthy that most surgeons who have written on the subject have been in each camp at different stages of their careers. Peace may be said to have come about through compromise, the limits of 'simple extraction' (without iridectomy), and the indications for iridectomy being now fairly well recognized on all sides. No surgeon of experience at the present day advocates *always* doing an iridectomy or *always* omitting it, any more than any surgeon now always performs a radical cure in strangulated hernia or always excises an aneurism. Perhaps the fairest way will be to tabulate the advantages and disadvantages that have been urged, and then to mention the conditions under which each method is better adopted. The reasons urged are :—

For Iridectomy.—(1) It cuts but does not bruise the iris, therefore it is less often followed by iritis. (2) The iris is much less often prolapsed after it. (3) It necessitates a smaller wound and less pressure to extract the lens. (4) A vectis is used more easily if it is necessary (fluid vitreous, dislocated lens, etc.). (5) Unripe cataracts are

more easily and safely extracted with iridectomy, as are complicated cataracts. (6) Capsule and cortex are more easily and thoroughly removed after it and vision is therefore better—after-cataract is for the same reason rarer.

Against Iridectomy.—(1) It prolongs the operation (slightly). (2) It is painful—sometimes serious if the patient moves and tears the iris from its attachment, but the pain is prevented by more thorough cocainisation. (3) Hæmorrhage possible (only if the iris is unhealthy). (4) Iris is cut and so injured (but cutting is less injurious than bruising). (5) Dazzling from large pupil (this is prevented by the upper lid and is rarely complained of even when iridectomy is done downwards). (6) Capsule may get into the wound (not likely if the ‘toilet’ is carefully performed).

For Simple Extraction.—(1) Facility of execution ; simple, easy and rapid. (2) No bleeding. (3) No dazzling. (4) Better cosmetic result (doubtful—the lids have often to be raised to ascertain if an iridectomy has been done—the coloboma is hidden by spectacles also). (5) Accommodation alleged to exist after it. (?) (6) Astigmatism alleged to be absent. (7) Better visual acuity. (8) The intact iris retains vitreous. (9) The intact iris prevents infection. (5) to (9) are either not proved or disproved by facts observed.

Against Simple Extraction.—(1) It bruises the iris. (2) Prolapse of iris is much commoner. (3) Evacuation of cortex is difficult and incomplete. (4) Discission of after-cataract is oftener necessary and is of greater danger than an iridectomy. .

This discission, besides being actually much more frequent, is rendered more probable for the following

reason. A round pupil has but one-third of the size of one enlarged by a coloboma. Hence the chance that an otherwise clear route for light is to be found *behind* the iris is, in the simple extraction, twice as great as in the case of the operation with iridectomy (Hansen Grut).

Reasons (2), (3) and (4) against simple extraction are weighty and will carry the day with most surgeons. For beginners there can be no question—an iridectomy should always be done. With more experience it may be omitted in healthy eyes with ripe lenses in quiet patients. It is better combined with irrigation.

An important question was formerly what kind of iridectomy—large or small—should be done for the extraction of cataract? In Graefe's modified linear operation a large coloboma was made to prevent the iris becoming incarcerated in the very peripheral wound. Since the incision has been made in the cornea, and the importance of careful replacement of the iris has been recognized, the necessity for making so large a coloboma has been less evident. But the chief reason for reducing the size and shape of the coloboma has come about from the real cause of prolapsed iris becoming better understood. Prolapsed iris, whether after cataract extraction or after perforating ulcer of the cornea, is the result of the ocular tension at the opening having diminished to that of the external air. This comes about usually, after extraction, from some effort on the part of the patient re-opening the wound. The aqueous flows towards the opening, and that in the posterior chamber pushes the iris in front of it. If the two chambers are in free communication either by means of an iridectomy, or by the pupil being well dilated with atropine, the posterior aqueous, as it may be called,

escapes easily and no prolapse occurs. If, on the other hand, there is no iridectomy and especially if the pupil is contracted by eserine, prolapse is more likely to occur, in spite of the sphincter being contracted by eserine.* Any

* It may be as well to state here my reasons for using atropine before and after extraction and not eserine. They depend on the mode of action of the drug. Atropine acts, I believe, by stimulating the radiating fibres of the iris more than by paralysing the sphincter. The reasons for believing this are that (1) in paralytic mydriasis from lesion of the third nerve instillation of atropine dilates the pupil still more. The sphincter fibres are already completely paralysed and vaso-constriction will not account for it, therefore atropine stimulates the dilator fibres ; (2) during cataract extraction where the pupil has been thoroughly well dilated by atropine, the pupil contracts on completing the section, and on the aqueous humour escaping, and again after the lens has been extracted. If the sphincter were paralysed this reflex contraction of it could hardly take place ; (3) after a narrow optical iridectomy the pillars of the coloboma frequently remain close together until atropine is instilled, when they rapidly separate and form a large pupil. Here the sphincter has been actually cut across without any dilatation occurring, yet atropine at once produces that effect, evidently by stimulating the dilator fibres ; (4) dilatation of the pupil by atropine where posterior synechiæ exists is evidently an active and not a passive dilatation ; (5) If atropine only acts by paralysis of the sphincter how can we explain the breaking down of recent adhesions by it ? (6) There is nothing remarkable in supposing atropine to have such action as it contracts the minute blood vessels and is believed to do so by stimulating their involuntary muscle fibres. It being granted that atropine acts as just described, my reasons for preferring it to eserine are (1) that by drawing on the pupillary margin from all sides the iris is held taut and prolapse of it in any direction is difficult, and (2) that a wide pupil provides a sluice through which the aqueous escapes easily from posterior to anterior chamber. It almost throws the two chambers into one, in fact, (3) a large pupil enables one to see most of the lens and to remove most of the anterior capsule with it, as it can be cut through over a much larger circle. Could one rely on the dilatation produced by atropine continuing there would be less necessity for iridectomy, but as mentioned above the pupil often becomes small after the section is made from increased vascularity consequent on reduction of pressure. Dilatation of the pupil by atropine, useful as it is, cannot take the place of iridectomy, quite apart from other indications for the operation. As a general rule both are necessary.

such contraction is annulled at the time of operation by the stretching the sphincter undergoes by the passing lens. Iridectomy, therefore, in order to prevent prolapse merely requires to be extensive enough to place the anterior and posterior chambers in communication with one another, and for this purpose a narrow coloboma not reaching quite to the periphery is sufficient.

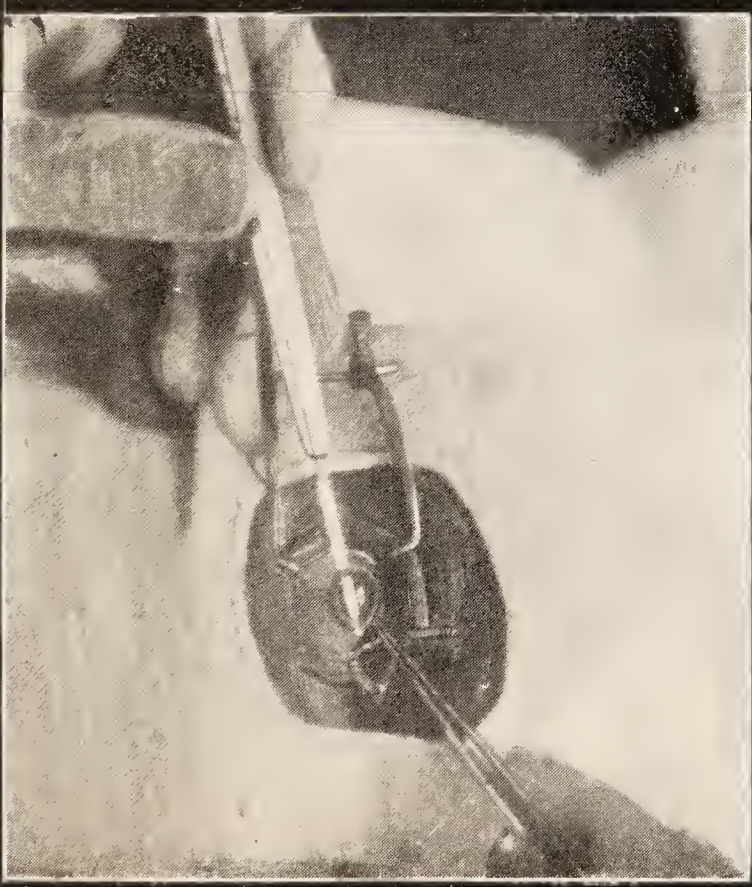
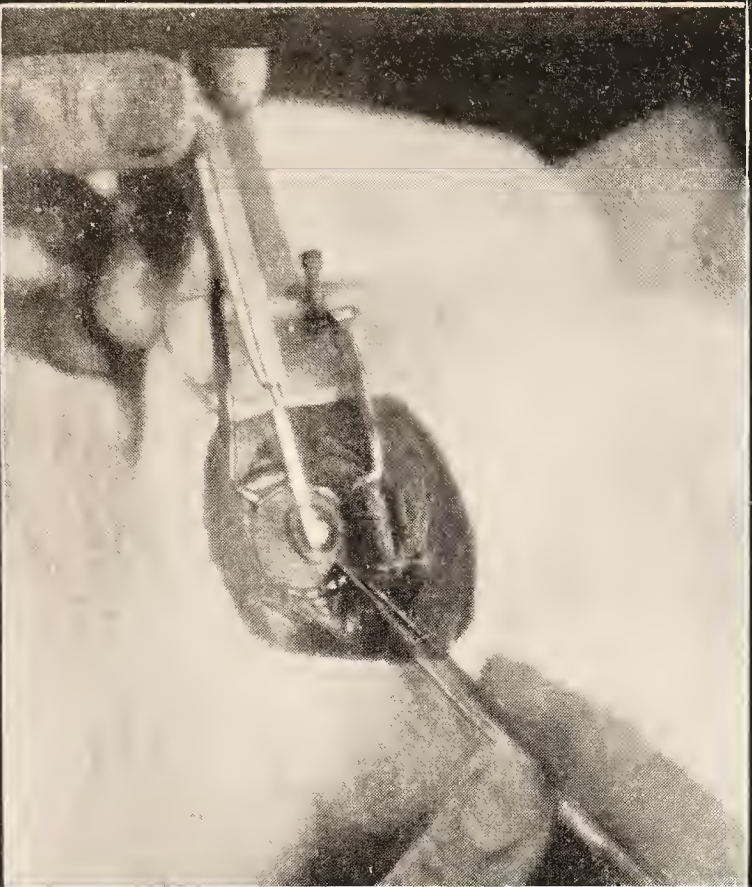
Cystitomy is done in various ways. De Wecker's or Treacher Collins' capsule forceps may be used to tear out a piece of the anterior capsule. They can only be used with a well dilated pupil, or after iridectomy and with a sound zonule of Zinn. Failing the former the iris is likely to be taken up as well, and if the zonule is weak, as in over-ripe cataracts, the pressure necessary to take up the capsule is likely to dislocate the lens into the vitreous with subsequent escape of the latter. With a tough capsule this is still more likely to occur.

The capsule may be cut, as already described, by the ordinary triangular capsulotome or by a lens hook. It is opened in various ways:— \cap , +, \circ . Of these the first is based on that recommended by Colonel Geoffry Hall, I.M.S. The opening below causes, he says, the lens to carry before it the bulk of the anterior capsule and so leave clearer vision. This is true, but one finds that with this limited opening the pressure required to rupture the rest of the circumference of the capsule and to start the lens on its passage is sometimes rather great. It is better, therefore, to start lacerating at the lower border of the pupil,

There are two other drawbacks to eserine in addition to those implied above, and they are important. One is the iritis it is generally believed to not infrequently set up. The other is the vomiting it sometimes causes. I have lost an eye after extraction from intra-ocular hæmorrhage due to vomiting, apparently caused by eserine which was instilled to prevent prolapse.

PLATE I.

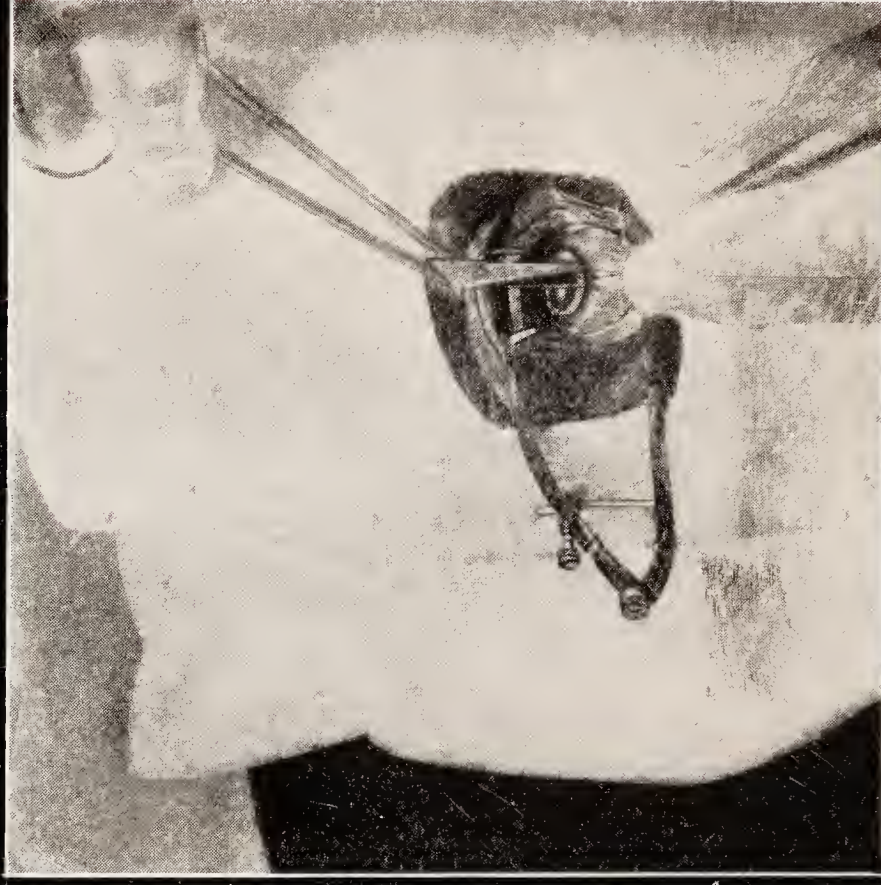
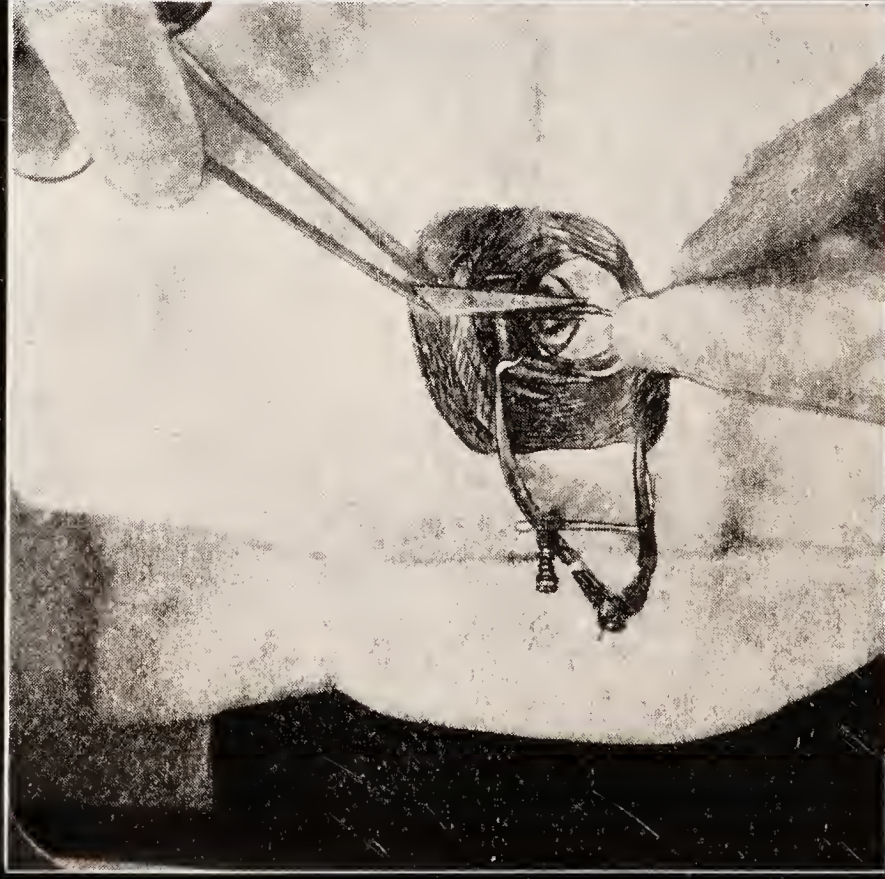
INCISION FOR CATARACT EXTRACTION.



Left Eye. Fixation forceps applied at 2 o'clock. Eyeball slightly rotated by them.

PLATE II.

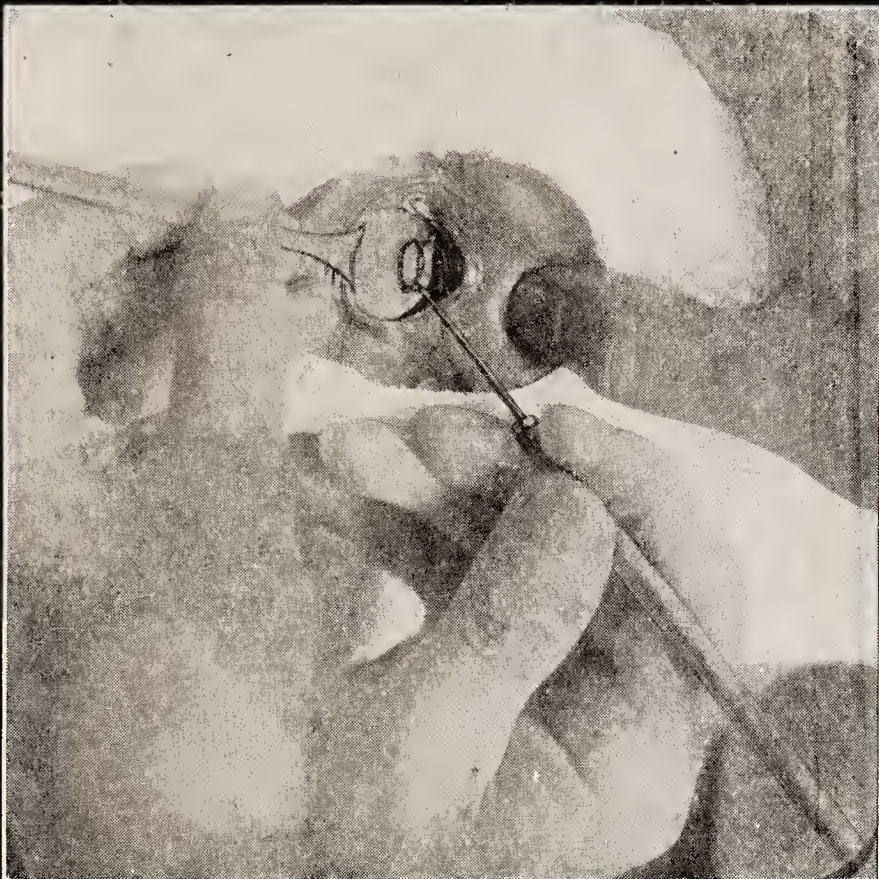
CATARACT EXTRACTION.



The Iridectomy.

PLATE III.

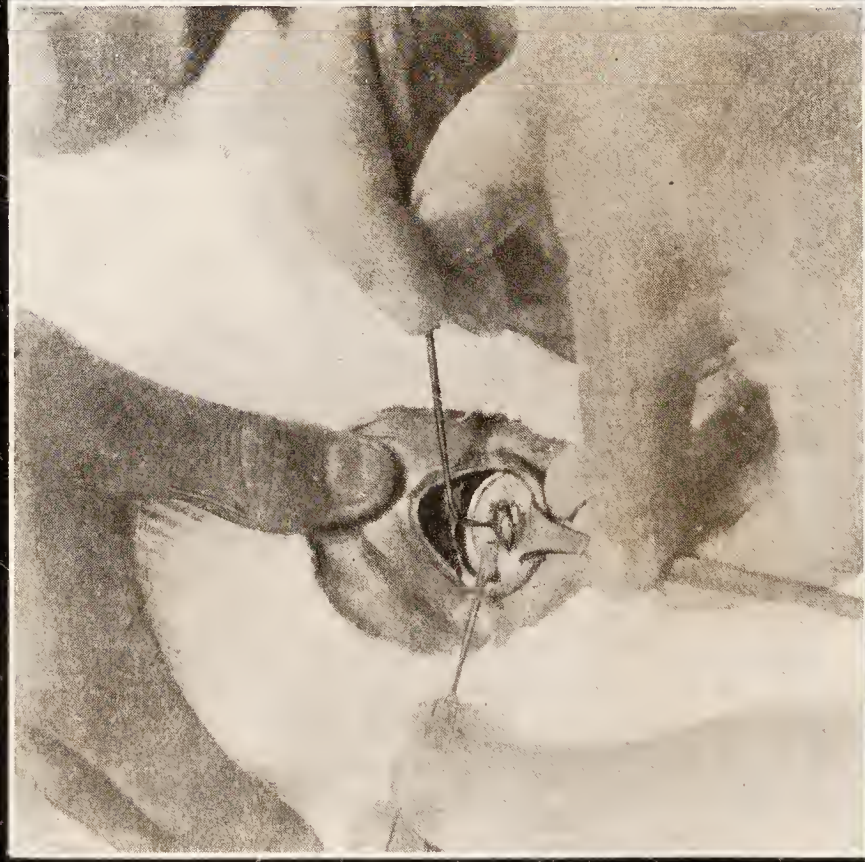
CATARACT EXPRESSION.



The Assistant's right thumb has slipped down the lower lid a little. Lens presenting.

PLATE IV.

CATARACT EXPRESSION.



Pressure applied by blunt end of inverted strabismus
hook and spoon. Lens starting forward.

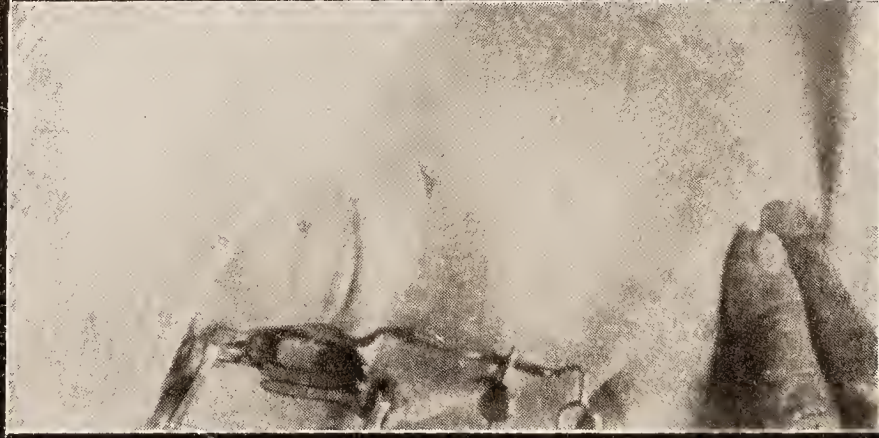
PLATE V.

OPTICAL IRIDECTOMY.



Section from below with keratome. Fixation
forceps applied above.

PLATE VI.



Extirpation of Lacrymal Sac.

and if the lens does not at once start forward, to continue the laceration all round. Some surgeons pierce the anterior capsule with the Graefe's knife as part of the corneal section, but there appears to be no advantage in doing this. Indeed, there is the disadvantage that as the knife has to be entered in a different direction to what it must ultimately assume, early escape of aqueous is liable to happen (*v. infra*, "Accidents") and an involuntary iridectomy may be the result.

The Madras surgeons* open the anterior capsule by a crucial tear with a Bowman's needle *before* making the corneal section. The needle is passed into the anterior chamber through the margin of the sclera, very peripherally in order to prevent escape of aqueous. This proceeding enables one to ascertain the character of the cataract to be dealt with and so modify the extent of the incision, but when the cortex is liquid or creamy it escapes into the aqueous and obscures the view. In most cases some aqueous escapes through the puncture, and the anterior chamber becomes shallower, making the incision much more difficult and wound of the iris probable. The disadvantages of this modification therefore seem to outweigh its advantages.

Accidents, Complications and their Treatment.

1.—ACCIDENTS AND COMPLICATIONS during THE OPERATION.

Reversed knife edge.—The edge of the knife should always be looked at just before making the puncture or it may be entered with the edge downwards instead of upwards. If this happens and aqueous has escaped, the

* T. H. Pope, *Indian Medical Gazette*, Vol. XXXVI, 1901, p. 201.

knife should be withdrawn and operation postponed till another day. The aqueous refills the anterior chamber in a few minutes, but the puncture remains, and if operation is attempted the same morning the aqueous will probably escape too early and difficulties be encountered.

Tearing of the conjunctiva.—This happens if the fixation forceps are too small and have not enough teeth. In old patients the conjunctiva is often lax and tears easily. The accident leads to no serious harm, but causes unsightly ecchymosis and prevents the globe being held as steadily as is desirable. Twisting the forceps after taking hold makes the grip firmer.

Too deep a counter-puncture.—Beginners generally push the knife point on in the anterior chamber as long as they can see it, before starting to make the counter-puncture. The result of this is that the point gets almost into the filtration angle before it enters the cornea, which is much too late. If a section of a cataract wound at the puncture be looked at, it will be seen how far away from the filtration angle the inner opening is. The point of the knife should be made to enter the cornea from the inner aspect (counter-puncture) well within view, and then the knife will emerge anterior to the limbus instead of deeply in it. Much unnecessary bleeding is thereby avoided. On finding the knife point is going too deep it should be very slightly withdrawn (aqueous escapes even so, generally) and the counter-puncture made at a more anterior plane. If it has entered too deeply for this, it must be pushed on, the edge being turned slightly forwards, and the section completed. Trying to raise the point by lowering the handle of the knife only leads to further escape of aqueous and a large involuntary iridectomy.

Early escape of aqueous humour.—Emphasis has already been laid upon the importance of completing the puncture and counter-puncture before making the section, and of then completing the section without any halting. If the knife is tilted at all at either end or edge, *i.e.*, not kept strictly parallel to its position when the counter-puncture is completed, the aqueous is almost certain to escape while the section is being made. The knife handle or point is easily raised unless it is guarded against, especially if the eye is deep set, or the palpebral fissure small, or if the patient screws up his eye forcibly. Undue pressure upon the globe by the fixation forceps causes early escape of aqueous, and vitreous also if that humour is liquid or the zonule too thin. The importance of avoiding such pressure has been well emphasised by Roberts.* When the aqueous escapes early, the reduction of pressure in the anterior chamber allows the lens and iris to bulge forwards, provided the ocular tunics are yielding enough to atmospheric pressure, as they are in all but the very old. The iris then gets pushed in front of the knife. When this happens the section must be completed and the partial iridectomy, if insufficient, made whole. It is no use trying to release the iris from the knife by applying pressure on the cornea with the finger. This only makes matters worse by completing the escape of aqueous. No harm usually results from the accident.

Involuntary iridectomy.—The principal cause of this has just been mentioned. Other causes have been advanced to explain it. Want of skill in not attending properly to the direction of the knife may no doubt cause it. Insuffi-

* J. R. Roberts, *Indian Medical Gazette*, May 1902, p. 196.

cient anæsthesia has been thought to account for it,* but it may occur under chloroform and in operating on the dead body.† Its occurrence in the soft eye of the cadaver may be explained by the tension of the globe having been restored by pressure of the fixation forceps. Dilatation of the pupil by atropine has been said to favour it‡ and eserine to prevent it.§ The area of iris to be traversed by the knife edge, and capable of being pushed in front of it, is so much greater when the pupil is contracted by eserine, that it is difficult to believe in this explanation, and we should *a priori* rather expect atropine to lessen the occurrence.

Too small a section.—This leads to difficulty in extracting the lens and to bruising, and perhaps loss of vitreous from the excessive pressure required. The lens moreover in being forced through an opening that is not large enough for it has much of its cortex scraped off it, and this has to be removed later, or remains to form perhaps an after-cataract. It is always better to make the incision too large than too small, and with asepsis, and especially with a conjunctival flap, there is no danger in doing this. Should the incision be found too small, or should the lens be found unusually large, it is better to extend the incision by scissors at either angle of the wound, rather than force the lens through an insufficient opening and run the serious risks this entails.

Slipping of the speculum.—This occurs sometimes, either from faulty construction or from the patient's restlessness. It may be replaced with great gentle-

* J. H. Tull Walsh, *Indian Medical Gazette*, July 1901, p. 242.

† W. G. Pridmore, *Indian Medical Gazette*, March 1902, p. 114.

‡ C. Duer, *Indian Medical Gazette*, October 1901, p. 396.

§ J. M. Macphail, *Indian Medical Gazette*, November 1901, p. 438.

ness, or, if the section has been completed, it is easier to finish the operation with the upper lid held up either by an assistant's thumb or by a retractor. It should be remembered that raising or removing the speculum does not prevent the patient compressing his globe with his recti muscles. If he can close his lids and squeeze the globe equally everywhere no harm is done, as the pressure is evenly distributed and the wound is supported as much from without as it is pressed from within. If the speculum is in or the lids are held apart in any way, this equality of pressure is disturbed and prolapse of iris or vitreous is probable. Some patients appear to have a retractor bulbi muscle like cats, and in them the use of a speculum or retractor is very difficult.

Hæmorrhage.—This may come from the flap, from the iris, or from within the eye. Bleeding from the *flap* is fairly frequent and usually of no importance. It soon stops, the blood escaping and being wiped away. Rarely, it is more copious and some of it passes into the anterior chamber, from which it is soon absorbed if it is left, though it can usually be stroked out or irrigated. This freer bleeding, when it happens, is sometimes due to the knife being turned towards the globe too soon and the sclera being wounded. This is avoidable. If it is likely to occur, as in an injected conjunctiva, adrenaline solution will prevent it. Where a vaso-dilator anæsthetic, such as alypine or eucaine is used, adrenaline also should be used. Bleeding from the *iris* rarely happens with a healthy iris. A diseased iris when cut bleeds freely, and as it is copious and all occurs in the anterior chamber it is a rather serious complication. This is due to the fact that when the iris is diseased inflammation of it readily occurs, and absorp-

tion of the blood is slow and sometimes incomplete. The blood should be stroked or washed out as far as possible and atropine instilled.

Intra-ocular hæmorrhage from the vessels of the choroid is the most serious accident that can befall an eye and invariably means total loss of sight. It may be met with in about half per cent. of the cases operated upon, but obviously this depends on the selection of cases to some extent. It is consequent upon the sudden reduction of tension in the eye. It sometimes begins immediately after operation, more often a few hours later, and may be so copious that the blood flows freely from the reopened wound, pushing vitreous out with it, and soaks bandages and even pillows. It begins upon the patient making some exertion, such as getting up, vomiting, or straining in passing urine or a stool. It is doubtful if it ever occurs in eyes that are healthy, though they appear to have been healthy in some cases. The patients probably had arterio-sclerosis. More commonly it will be found that the cataract was over-ripe, or that the tension had been increased and that the eyes had a glaucomatous tendency. If it is decided to operate upon a cataractous eye in which the tension is raised special precautions are necessary. The speculum should be dispensed with or removed on completing the section, a preliminary iridectomy is advisable where possible, and careful bandaging and absolute rest in bed must be observed after the operation. If severe hæmorrhage occurs and the upright position, pressure (which cannot always be borne) and morphia do not stop it, enucleation will be required.

Insufficient opening of the capsule.—This is the probable cause when, with a large corneal incision, the lens still refuses to be delivered. Its reluctance to come may be due

to posterior synechiæ, but these will have been indicated beforehand by incomplete or irregular dilatation of the pupil by atropine. The cystitomy should be repeated more thoroughly. The predicament one is placed in when the lens refuses to come under these circumstances is well put by Landolt* who says: "The cataract does not stir, and, although it seems to us that we have traversed the capsule with our instrument, we are not very sure of the extent of the incision that we have made. If, then, the cataract does not yield to the pressure made upon its equator, one wonders, with anxiety, to what this resistance is due. Could the corneal incision be too limited, or, what amounts to the same thing, could the lens be more voluminous than we had supposed? Is it the iris (when no iridectomy has been made) which resists? Is the cohesion, between the crystalline and its capsule particularly strong, or is the capsulotomy insufficient? Is it necessary to enlarge the corneal wound, or increase the pressure made upon the recalcitrant crystalline? Is it best to have recourse to iridectomy, with which one had supposed one's self able to dispense, or renew the manœuvres of the capsulotomy? Or is it better to resort at once to radical measures and remove the cataract with a traction instrument? According as the operator recognises, or fails to recognise, the cause of this little incident, the result of his operation will be a success, a partial success or even a failure."

A good light is essential for the diagnosis, as to which of these causes of difficult extraction is at work. If the incisions in the cornea and in the capsule have been large enough and an iridectomy has been done, it will be neces-

* Landolt. *The Ophthalmic Record*. Vol. II Nos. 4 and 5, p. 170.

sary, if the lens refuses to come on moderate pressure, to use a vectis inserted from behind the upper edge of the lens to extract it. Prolapse of vitreous is to be expected.

Prolapse of Iris may occur during the operation or later, in about three per cent. of the cases. It may be due to some fault in the section or to bruising of the iris by the passage of the lens. The more peripheral and scleral the section the more likely it is. It is also more common when the simple operation (without iridectomy) is performed (in about ten per cent.), partly because the iris is bruised more in it. It more rarely happens where an iridectomy is done. After the operation prolapse is brought about by some sudden exertion of the patient opening the wound, and by the aqueous from the posterior chamber carrying the iris in front of it in its passage towards the wound, as already explained on p. 84.

When prolapse of iris occurs during the operation it should be replaced with a curette, and if it recurs or if the pupil does not become round and central before the eye is about to be closed, an iridectomy should be performed or, if one has already been done, the prolapsing pillar should be excised, making the coloboma larger it is true, but preventing further prolapse. When it occurs later the bandage and pads should be removed, the eye cocainised, and the prolapse cut off with scissors. The iris should be drawn out a little with iris forceps before it is cut and the pillars of the resulting coloboma carefully stroked into place. This necessitates reopening the wound, of course, but this is better than leaving the prolapsed iris to interfere with healing, set up prolonged irritation, and be a constant source of danger from infection, until it has shrunk after much painful treatment with cautery or caustic. Timely excision does away with all this. The

only exception to the rule of treating prolapse by excision of it is when a few days after an extraction with iridectomy, one pillar of the coloboma becomes involved in the wound, as it rarely does. The slight projection of iris in such cases may be left alone at first. Bandaged pressure usually prevents its increase, and if it does not shrink and flatten, as it usually does, in a week or two, it may be touched with a cautery, but excision of it is not required. It shows little or no tendency to increase and draw the whole iris upwards, as a prolapse after the "simple" extraction so often does.

Prolapse of vitreous occurs in five or six per cent. of extractions. The percentage grows less with the greater experience of the operator. This accident is more serious when it precedes the escape of the lens than when it succeeds it. Occurring early in the operation it is usually due to hypermaturity of the lens and weak zonule of Zinn, or to fluidity of vitreous. It is impossible to continue to extract the lens by pressure, as that increases the prolapse without moving the lens. The speculum should be at once removed and Taylor's ring-shaped vectis (fig. 43) introduced behind the lens to extract it. When the vitreous is thin there is no need to cause delay by trying to cut it off. The eye should be carefully bandaged. If the lens is not over-ripe and the zonule thin the prolapse is probably due to excessive pressure used to extract a lens through a small wound or with an insufficiently opened capsule. In such a case the wound should be enlarged before introducing the vectis. When



FIG. 43.—Taylor's Vectis.

vitreous prolapses after the escape of the lens it may be due to the same causes as when it escapes earlier, or it may be due to pressure of the speculum on the globe from the patient's screwing his eye up. It is much commoner when the lens is removed in its capsule. The hyaloid membrane is necessarily ruptured when vitreous prolapses. If the vitreous is normal like unboiled white of egg, the prolapsed portion should be cut off with scissors. After the accident the upper portion of iris is invisible. It is not prolapsed externally but apparently pushed upward and backward, inverted in other words, by the vitreous, away from the wound. This process continues during the healing process and the pupil is opened out and drawn upwards for weeks after, so that it is always easy to recognize an eye in which a considerable quantity of vitreous has prolapsed by the three-quarter moon-shaped pupil displaced upwards which remains. A similar appearance is sometimes met with after expression in the capsule where no vitreous has prolapsed and is difficult to explain unless the pressure used is responsible. The dangers of vitreous prolapsing are the increased chance of infection presented by the vitreous in the wound communicating with the interior of the globe, intra-ocular hæmorrhage from loss of support in the uveal vessels, and detachment of the retina from the same cause, particularly in myopic eyes. If it occurs in them it generally goes on to complete blindness.

Luxation of the Lens.—When this is found to have occurred before operation, from hypermaturity or ‘couching,’ it leads one to expect prolapse of vitreous and precludes the use of any pressure. The vectis should be used and no speculum. Unless recent there will be synechiæ and on the duration and strength of these turns in part the question of advisability of interference.

When it occurs during the operation, generally from the use of too much pressure in the cystitomy, especially in over-ripe lenses, the speculum should be removed, an elevator substituted, and the lens removed by a vectis. Prolapse of vitreous follows. In some reported cases the lens was not recoverable and the search for it had to be abandoned.

Collapse of the cornea.—In some eyes the cornea sinks in after the aqueous humour has escaped. This means that the globe has not become reduced in size to a degree corresponding to the amount of aqueous that has escaped. For it is obvious that if the globe were rigid and irreducible in size no aqueous could issue after making the section. The reduction in size of the globe that usually occurs is brought about by the natural elasticity of its tunics and by the pressure of the lids and rectus muscles. In old persons with thin corneæ and thick non-yielding scleræ and deep set eyes, collapse of the cornea is likely to occur from pressure of the air upon it.

Cocaine by reducing tension is said to favour it. The collapse rapidly disappears when the aqueous humour reaccumulates as it generally does in a few minutes. No treatment is necessary. On raising the flap of such a collapsed cornea air passes in by aspiration. No harm ensues. It is well to stroke it out, however, as if left it may take time to get absorbed. The capsulotomy is more clearly visible if there is air in the anterior chamber.

II. ACCIDENTS AND COMPLICATIONS **after** THE OPERATION.

Œdema of the flap.—This occurs rarely and is generally due to aqueous collecting under it. It is met with in cases where the flap is united, as it usually is almost

at once, and then becomes disturbed and pressed upon by aqueous forced out during some effort on the part of the patient. It is commoner when large flaps have been made. Continuing the bandage and making it a pressure instead of a protective bandage removes it.

Cystoid Cicatrix.—The same explanation holds for this as for the filtration œdema just described. Instead of producing œdema, however, the aqueous causes the cicatrix to bulge out in the form of a cyst. It will generally be found that some iris or lens capsule has become incarcerated in the wound keeping its edges from uniting properly. If due to iris the pupil will be drawn up gradually as healing occurs. Whatever it is due to the eye is exposed to the danger of infection and iridocyclitis until the wound is soundly healed. Irregular astigmatism from irregular curvature of the cornea is likely to result. The cyst generally lasts for some weeks. A pressure bandage should be maintained until it has disappeared. It may have to be excised.

Delayed union of the wound is occasionally met with. The general health is usually at fault. But it may be due to restlessness of the patient repeatedly forcing open a healthy wound. More often it is really a delayed healing process, such as may occur anywhere. The rise of pressure in the anterior chamber, due to reaccumulation of aqueous humour, forces open the wound. This begins to heal again slowly, and is again forced open. Continued bandaging is necessary. If this fails, slight cauterisation of the edges of the wound may induce more rapid healing.

Delayed re-formation of the anterior chamber.—This may be due to the same causes as delayed union and generally goes with it. Sometimes continued bandaging

and sometimes omission of the bandage does good. Dionine (2 p. c.) may do good, provided sneezing is guarded against, by pressure just above the upper central incisors.

Bursting open of the wound.—The patient usually causes this accident by turning over on his face during sleep, or by hitting the eye with something, or by sneezing or coughing violently. Blood is poured out into the anterior chamber and wound, but is soon absorbed in a healthy eye, and unless iris has been forced into the wound no further harm is done. An ice-bag should be applied over the dressings and the patient kept entirely at rest for a few days. If iris has been forced into or out through the wound it should be excised in the manner already described.

Striped opacity of the cornea is found in the form of greyish white striæ situated on the posterior surface of the cornea. They either radiate from the wound or are more irregularly disposed. They are generally found at the end of twenty-four hours and pass off after some days without interfering with the healing process. In such cases the incision has been small relatively to the lens and it has been bruised by the passage of the lens. It is commoner after expression in the capsule. The opacity has been attributed to wrinkling of Descemet's membrane, and to actual injury of the posterior endothelium. The latter is more probable as the opacity follows the direction taken by the injuring agent, *e.g.*, the large lens, capsulotome, etc. No treatment is necessary. Prevention consists in making a large enough incision, and in careful avoidance of any injury to the endothelium by the cystitome.

Mercurial clouding of the cornea occurs when too strong solutions are used in the conjunctival sac after the

globe has been opened and especially if any solution passes into the anterior chamber. Perchloride appears more injurious than biniodide solutions of similar numerical strength. No solution stronger than 1 in 5000 of either should ever reach the incised cornea. The cloudiness is diffused and unaccompanied by any signs of inflammation. If at all well marked it is liable to remain permanently and seriously reduce visual acuity. Its occurrence is one strong objection to the introduction of iris forceps or other instruments into the anterior chamber to remove capsule or cortex, as thereby any solution lying in the sac is likely to be brought into contact with the posterior surface of the cornea. It also emphasises the importance of washing out the conjunctival sac with normal saline solution immediately before operation. No treatment appears of any use. Slight cases clear up. In those that do not a weak solution of iodide of potassium introduced into the anterior chamber might be of use, but it does not appear to have been tried.

Delirium occasionally occurs in old people. Leaving off the bandage in the un-operated eye and giving if necessary a hypodermic injection of morphia or a dose of sulphonal are indicated.

Erythropsia.—Sometimes the patient complains when he begins to use his eye that everything seems red or sometimes blue. At other times all objects appear dazzlingly bright. These troubles gradually disappear with further use of the eye.

Detachment of the Chorioid.—Knapp first, and Fuchs later,* drew attention to this complication. It may be suspected where the anterior chamber empties after

* Fuchs, *von Graefe's Archiv. f. Ophthalmologie*, iii, 3, and *Ophthalmic Review*, Vol. XXI, p. 154.

reforming or fails to reform, and the suspicion can be confirmed by ophthalmoscopic examination. It is said to occur in about 5 p. c. of all extractions, in equal proportion after simple and combined extractions. Cases with rigid sclerotics are more liable to it, *i.e.*, cases in which the cornea often becomes concave. Prognosis is good as regards sight.

Glaucoma rarely occurs after extraction in an eye that was previously healthy. Treacher Collins has shown that in such cases there has been an incarceration of iris or capsule or hyaloid in the wound. This has blocked up the filtration angle. In some cases the corneal epithelium has grown into the incision and through it has spread round the anterior chamber. This is unlikely to happen with a conjunctival flap. Iridectomy, and that failing sclerotomy, should be done at once.

Suppuration.—This serious and preventible issue generally comes on within twenty-four hours of the operation and rarely more than two days after it especially if a conjunctival flap was made. It may occur absolutely without any pain. Usually there is severe aching pain in the eye and around it. Lacrymation occurs and the discharge of muco-pus. The lids are swollen early and chemosis follows. The eye is deeply injected and the wound covered with a greyish yellow layer of lymph. The cornea is hazy and rapidly becomes opaque. The pupil is obscure and the aqueous humour turbid. Vision fails. Hypopyon is soon present, though as the patient is recumbent the exudation is usually diffused throughout the anterior chamber. The cornea breaks down, sloughs, and the whole eye suppurates—panophthalmitis—resulting finally in phthisis bulbi. The rapidity with which these stages are passed through

vary, and the stage at which they cease varies also. The whole eye may be suppurating in a couple of days or the process may stop short after the exudation of lymph into the anterior chamber. This may clear up entirely with proper treatment. In such cases recovery may be complete. Usually, however, the eye is completely lost. Prevention is all-important. Treatment must be active and prompt. The wound may at once be cauterised from end to end with the actual cautery under cocaine (using a crystal of the drug for the purpose) or washed with formol solution 1 in 2000. A few grains of sterilised iodoform may then be introduced into the anterior chamber by means of a curette passed in through the wound, the rounded side going in first. On turning it round inside the chamber the iodoform remains there. Atropine is to be instilled every four hours and hot boracic or belladonna fomentations applied. Four or six leeches to the temple are useful, or Herteloup's artificial leech may be applied. The conjunctival sac should be washed out with 1 in 2000 mercuric iodide solution. Mercury given internally is useful. Some cases yield to these measures and some vision is saved. More often the eye is lost. As it shrinks and there is little danger of sympathetic inflammation, it may be left in its socket unless cosmetic considerations demand enucleation.

Iritis.—A slight degree of iritis is fairly common. The adhesion of iris to capsule which is so frequent is the result of a mild and localised iritis due to traumatism. Capsule and cortex that have been left behind are liable to set up iritis, by irritation apparently. Antecedent iritis may light up again. Iritis is less common after expression in the capsule. When severe, however, iritis is generally due to infection, though constitutional causes

undoubtedly do explain some cases. The iritis may vary in degree from causing simple blocking of the pupil up to matting of all the parts together, cyclitis and later on sympathetic inflammation of the other eye. Iritis causes pain in the eye, deep injection and lacrymation. The lids may swell. The pupil is small and irregular, not always easily seen as there may be lymph in the anterior chamber. Hypopyon may form. It will be seen that iritis and suppuration have some signs in common. In iritis, however, the wound and the cornea remain free from infiltration, and the process is evidently a more localised one concerning chiefly the iris. Treatment consists in leeching, hot fomentations and atropine frequently applied, mercury internally and by inunction. For the blocking of the pupil subsequent operation may prove advantageous, performed long after everything has been quiet, and only if perception and projection of light are good.

After-cataract is the term applied to the opacity sometimes found to interfere with clear vision after extraction. It comes about in one of two ways. Either some of the cortical matter left behind at the operation becomes shut off from the dissolving effect of the aqueous humour, or the epithelium of the lens capsule proliferates and causes the capsule to become opaque. The former is met with commonly when unripe cataracts are operated upon and much cortex remains. It is rarer when the cataract is ripe and the cortex is liquefying. As long as the cortex is exposed to the action of the aqueous humour, it goes on swelling up and being absorbed. The capsule curls up, however, when the anterior portion is divided by the capsulotome, and may shut off some of the cortex left behind from the aqueous. This then remains as an opacity interfering with vision. The

proliferation of capsular epithelium, when it occurs, is a later process. Sometimes where the aqueous does not seem to possess its usual dissolving power, the pupil and anterior chamber remain filled with boiled-sago-like cortex. In such cases needling does but little good. Dionine helps in the absorption of the cortex. In some cases the posterior layer of the lens capsule remains like a fine web seen deeply in the pupil and interferes considerably with sight. It is only recognised with careful focal illumination, as on ordinary inspection the pupil seems quite black. After expression in the capsule after-cataract forms if the capsule ruptures ; even without rupture the hyaloid membrane in some cases appears to become wrinkled and to interfere with sight.

All these kinds of after-cataract, if they interfere with visual acuity, require operation by needling. If they do not interfere, and, unless centrally situated, they often do not, they may be left alone.

The term Secondary Cataract is applied to cataract forming as the result of disease in the eye or to the exudation blocking up the pupil after iritis following extraction. The term should be limited to those conditions and not used for the non-inflammatory obstructions described above.

Much difference of opinion exists as to the appropriate time for needling after extraction. It appears rational to do it as soon as the surgeon is convinced that no more clearing up by absorption will take place, and before the after-cataract becomes firmly attached to the iris, and thickened perhaps too, so that its division is likely to be difficult and dangerous. The advantages of delay are dubious, and the eye is found in practice to tolerate discission better shortly after extraction than

later when everything has quieted down. With native hospital patients an additional reason may be found in the fact that once discharged from hospital, they are more likely to remain content with indifferent vision than to return to undergo another operation for its improvement.

For the needling, the same preparation, anæsthesia and instruments are required as for "discission" already described (p. 61), with the addition of a second needle, and of a cutting needle (fig. 44).

If the after-cataract is recent and soft, and there has been no inflammation in the eye, a single needle may suffice, used as in "discission." If the membrane is at all thick two needles should be used, passed in at opposite sides through the sclero-cornea until they almost touch in the centre of the pupil. They are then rotated, made to puncture the membrane, and the handles being raised, the points separate and tear an opening in it. By tearing it open in this way no strain is thrown on any iritic or ciliary body adhesions there may be. If the membrane is tough a needle with a cutting edge is better, and the hole is made by cutting and not by tearing. The after-treatment is the same as after discission.



FIG. 44.—Cutting cataract needle.

CHAPTER VII.

OPERATIONS ON THE LENS—(*continued*).

EXPRESSION (SMITH'S OPERATION)—CZERMAK'S OPERATION.

Expression (Smith's Operation).

Indications:—Smith expresses all cataracts, except juvenile and atrophic (? Morgagnian) and the semi-gelatinous variety in adults, in which “the lens occasionally has a peculiar bluish tinge.” In these the capsule, he says, is weak and liable to become ruptured. As already stated, the author considers over-ripe cataracts (including Morgagnian), the most suitable for the operation. Unripe cataracts are suitable, if operation is needed on account of loss of livelihood or very slow maturation (p. 55).

This is the conclusion the author has come to after considerable experience of both extraction and expression. In a paper on expression, written in 1906,* he summed up the *pros* and *cons* as follows:—“The *advantages* of the operation are : (1) only one instrument, besides the knife—the iris forceps—is introduced into the interior of the eyeball, and so there is less chance of infection, especially as the piece of iris touched by the forceps is removed ; (2) complete removal of capsule and cortex, and so better vision, with removal of one of the main causes of indifferent sight after extraction, and of one of the minor causes of iritis. Impaction of the capsule

* “Cataract Expression (Smith's Operation): Results in 175 operations.” *Indian Medical Gazette*, Vol. XLI, August 1906.

in the wound with all its dangers is avoided also. The *disadvantages* of the operation are: (1) frequent loss of vitreous with its dangers of detached retina, hæmorrhage, increased chance of infection, etc.; (2) prolonged lowering of tension and haziness of cornea with poor vision. This may occur without prolapse of vitreous; (3) delayed union, which may occur even with a conjunctival flap and with a peripheral incision, due to the pressure applied. Prolonged redness, lacrymation and chemosis with drawing up of the pupil are apt to be found in such cases; (4) frequent rupture of the capsule with its bad effect on vision. In face of these grave drawbacks it is impossible to recommend the performance of the operation, and personally I have returned to the practice of removing lenses in their capsules only when they are over-ripe and have thick capsules; those cases in fact in which I have generally removed the lens in its capsule, years before expression was heard of, making use of the improvements of technique introduced by Smith."

As the result of further experience, particularly in the expression of unripe lenses, the author is able to go further than in 1906, and to endorse Smith's contention, that the operation is suitable for removing unripe lenses also. He finds, when no selection is made and *all* senile cataracts are expressed, that the visual results are no better than after extraction, not as good on the average in fact. This is leaving out of account the question of ultimate impairment of sight that may result from vitreous prolapse. That question requires the observation of a considerable consecutive series of cases for a number of years and is not likely to be solved in India where we lose sight of most of our cases so soon. In the best cases the results are excellent. So they are after

extraction, without the risks involved in expression being incurred. No operation, however, should be judged by its best results, but by its average, and that too in the hands of the average ophthalmic surgeon. So judged, extraction will hold its own and for beginners there can be no question; expression is no operation for them. When they can extract with an average of about five per cent. vitreous prolapses, they may feel confident that their delicacy of touch and skill are sufficiently developed to

justify their attempting expression—in suitable cases even then, it should be added—after seeing the operation performed by someone who can do it. By adopting expression for unripe and over-ripe cataracts, in which extraction is at its worst, the average results will be much improved, and in unripe cases long periods of weary waiting will be cut short.

Instruments :—As for cataract extraction with the addition of a strabismus hook (not flattened, fig. 100), ordinary dissecting forceps, and a large thick strabismus hook (fig. 45), or small Desmarre's retractor (fig. 34) for raising the upper lid.

Anæsthesia :—As for extraction.

Smith instills cocaine once only.

Method * :—The eye is prepared in the usual way,† and a speculum inserted. Smith uses one with a weak

* For further details, see papers, by Major H. Smith, I.M.S., in the *Indian Medical Gazette*, Vol. XXXV, 1900, and Vol. XL, 1905.

† Smith douches the conjunctival sac out forcibly with 1 in 2000 perchloride lotion from a vessel suspended four or five feet above the patient. The lashes are not cut and no atropine is used.



FIG. 45.—Critchett's strabismus hook.

spring and no screw stop. Grasping the conjunctiva in the middle line below the cornea, Graefe's knife is made to puncture the cornea at three and nine o'clock, *i.e.*, across the centre of the pupil. It is inserted through "the sclero-corneal junction just as deep as anatomy and experience teach us will avoid wounding the dangerous area, and cut out in the cornea with a sweep half-way between a normal pupil and the sclero-corneal junction."* A small iridectomy is next done in the way described under extraction. The speculum is removed and the assistant draws the upper lid up with the nail surfaces of the ring and little fingers of his left hand (Plates III & IV), and then inserting the small retractor or a thick and blunt strabismus hook under the upper lid with his right hand, he places the handle of it within the grasp of the left thumb and remaining fingers. By this means he raises the upper lid well off the globe and controls the orbicularis muscle in its upper portion. He now presses the pad of his right thumb against the lower lid, and gently but firmly drawing it down, he lifts the lower lid off the globe and controls the lower half of the orbicularis. To make his fingers hold and not slip they and the patients' skin should be dry, or he should wear sterilised cotton gloves or gauze wrapped round the fingers and thumb. A good and practised assistant is essential. For the left eye the assistant may stand in the same place, on the patient's right; or he may come round to the patient's left side and use his right hand for the upper lid and his left for the lower. The

* Major Smith now says (1906), the operation can be done just as well with one incision as another. Expression is easier with the forward incision, though healing is slower and infection more possible. The author prefers a conjunctival flap as a rule.

operator has to pass his right hand under the assistant's left wrist in operating on the right eye, taking care to touch nothing with the strabismus hook on the way; for the left eye, both his hands may be above the assistant's if the latter remains on the right of the patient. If he stands at the left, which is less tiring for him, the surgeon passes his left hand under the assistant's right wrist. The patient looks straight to his front for either eye or upwards if he prefers it. The surgeon had better use his right hand for the strabismus hook to express with, and the left hand to hold a spoon to give assistance to the other, it required.

The eye is now ready for the expression, which is performed as follows : A strabismus hook with a rounded and not angular curve is used ; one thicker than usual is less likely to damage the corneal epithelium. It is held in the right hand and the convexity of its curved portion is placed on the cornea about the junction of the lower with the middle third of the lens and steady, but gentle pressure is then made with it in the direction of the posterior pole of the eye. The wound gapes and the upper edge of the lens bulges into it, with the edges of the coloboma made in the iris showing in front of it. As pressure is continued, these edges recede towards either angle of the wound, and the lens edge comes gradually forwards, sometimes with a slight start and distinct giving way of what is probably the zonule of Zinn (Plate III). The lens is followed up by the strabismus hook and when expressed falls to one side into the conjunctival sac. The pillars of the iris are freed from either corner of the wound, and the lids lowered into position.

*Accidents :—*There may be *difficulty in expressing the lens*. In some eyes the sensation received on pressing the

strabismus hook is as if the eye were spongy. The wound hardly gapes and the upper edge of the lens does not move. If the lens does not start moving at all on executing the manœuvre with spoon and hook to be presently described, expression in such an eye had better be abandoned before it ends in rupture of capsule (or) and prolapse of vitreous. Ordinarily difficulty in expression is met by continuous steady pressure of the hook in a backward direction kept up for some minutes. There must be no hurry ever in this operation.

Should the lens not move with moderate steady pressure of the strabismus hook, the spoon (fig. 41) held in the left hand is applied to the cornea low down and just to the left of the hook, and the hook is then turned round, the pressure being kept up by the spoon, and the tip of the hook is pressed on the cornea, instead of the convexity of the curve as previously, to the right of the spoon (Plate IV). The spoon and the hook-tip are now pressed on the lens and slightly separated at the same time. This will often start a refractory lens, and is a useful modification of his technique recently introduced by Major Smith. Should this manœuvre fail, the strabismus hook is reapplied as at first, and the spoon is used to apply counter-pressure on the sclera near the centre of the wound. Moving it slowly along from one end of the wound to the other sometimes helps to express the lens. When the lens is nearly out it may be finally delivered by bringing the hollow of the strabismus hook round its edge and pushing it out at the last, or while maintaining pressure with the hook the spoon may be used to push or draw the lens out sideways, care being taken to apply only its flat surface to the lens and not to rupture the capsule by using the edge at all.

Too small an incision is remedied by enlarging it with blunt-pointed scissors at either end. This should be done at once if necessary.

Keratitis is met with occasionally, but usually clears up without trouble.

Delayed union is met with sometimes in cases where the incision has been made forwards in clear cornea. When a conjunctival flap has been made it is unknown. Growing in of the corneal epithelium occurs between the edges of the wound. The epithelium is gradually pushed out again, but healing is prolonged, the scar is weak and liable to burst open, and the danger of infection continues for some days, as in a case of the author's where one such eye suppurated, although the fellow eye expressed in the same way, but with a conjunctival flap healed at once (*cf.* Parsons : *Pathology of the Eye*, Vol. I., pp. 151 to 165).

Prolapse of vitreous varies with different operators and is less the greater their experience of the operation and the better trained their assistants. Major Smith records 6·8 per cent. ; others have reached nearly 40 per cent. Its frequency is the chief drawback to the operation and bars it entirely for beginners. The prolapse may occur at any stage of the expression ; it is commoner with fluid vitreous than when it is normal. Slowness in expression helps to reduce the number of cases of it. Smith lays stress upon not making the patient look down, as doing so encourages prolapse. If the assistant raises the lids properly expression can be done with the patient looking up. An escape of liquid vitreous from the wound, after the operation has apparently gone off all right and the eye has been closed, is not uncommon, and may easily be overlooked. At the dressing on the next day it will often be

found to be still going on, especially if the incision has been a forward one, not often if there is a conjunctival flap which is usually united within twenty-four hours. If vitreous shows behind the lens early on, the spoon in the left hand is pushed through between it and the lens, and the latter is removed on the spoon. In this way a little vitreous will escape instead of a good deal. If vitreous escapes before the lens or during expression, Taylor's vectis must be passed in behind the lens and used to withdraw it. Should the vitreous escape after the lens is removed, the lids are closed and the bandage applied. If the vitreous is normal, the protrusion is cut off. If liquid, this is not necessary.

Rupture of the capsule is a serious accident as regards subsequent sight. The frequency of it varies from 8 to 17 per cent. when cases are expressed without selection. It is commoner when there is disproportion between the size of the wound and the size of the lens, *i.e.*, when more pressure has to be used, or when it is applied too rapidly. It oftenest occurs just as the lens appears on the point of coming out. It is less likely to occur in unripe lenses where the capsule is normal, and in over-ripe lenses where it has become tough. It is most likely to occur in ripe lenses with thin capsules, in which the cortex is just becoming slightly liquefied, those with glistening grey well-marked radiating striæ. Attempts to draw or push out the lens with a spoon may cause rupture. Much may be done therefore to prevent it by selection of suitable cases, avoidance of haste, use of a large enough incision, and the non-use of aids to expression unless absolutely necessary and then only with the greatest care and gentleness. When it occurs pressure with the strabismus hook must be maintained, or the broken capsule

will slip back into the anterior chamber, and a pair of dissecting forceps must be taken up in the left hand and used to draw out the protruding capsule if possible. Sometimes all of it will come away and the result be as good as if it had not happened, but if the capsule ruptured early on this is not likely, and only some fragments will be removed, the main part of it, together with a varying amount of cortex, remains behind, and, having been partly displaced during expression, makes a worse after-cataract than ever results from extraction. Should no vitreous have prolapsed as well, irrigation may be employed. Should it have prolapsed this is out of the question of course, and the access of vitreous to the remains of capsule and cortex appears to render the absorption of cortex slower than usual.

Prolapse of iris is rare when iridectomy is performed. The pillars of the coloboma are considerably bruised by pressure, and atropine has no effect and is not needed after operation.

Iritis is uncommon, which shows that the usual cause of iritis after cataract operations is not bruising but the presence of capsule and cortex, and in some cases sepsis.

Irritability of the eye, injection with lacrymation pain, and sometimes chemosis and œdema of the lids, occurs in some cases of expression, in which there has been no complication and in which the sight is and remains good. It comes on after six or seven days apparently normal course. The irritation subsides gradually but may continue for weeks even. No explanation is known of these cases, which have been met with by different observers, unless it is due to the pressure exerted upon the eye.

After-cataract.—The absence of this and of iritis are the chief advantages of expression. Should the capsule rupture after-cataract forms unless the capsule can be removed. This has already been dealt with.

After-treatment is the same as after extraction, except that atropine is unnecessary for reasons already given. In some cases of irritability indeed eserine was the only drug that gave relief, after dionine had ceased to relieve ; although there was no increase, decrease rather, of tension.

Subconjunctival Extraction (Czermak).*

Indications :—When the conjunctival sac cannot be made healthy, as in inveterate cases of trachoma ; or when there is probability of vitreous prolapse as in tremulous lens from hypermaturity, cases of asthma, chronic bronchitis, etc., this method of extracting is very useful and safe.

Instruments :—As for extraction of cataract.

Anæsthesia :—Local. Adrenaline is advisable to lessen the hæmorrhage which otherwise is considerable.

Method :—In operating with a downward section on the right eye, the conjunctiva is raised near the limbus at 2-30 o'clock by fixation forceps. The Graefe's knife is made to pass through the raised fold and then enter the anterior chamber ; the puncture is thus accomplished subconjunctivally, as in subconjunctival discission. As the knife is passed on across the anterior chamber, its point may be made to open the lens capsule ; the counter-puncture is made at 9-30 o'clock, and the knife is withdrawn. So far the operation rather resembles an anterior sclerotomy. The conjunctiva is now incised with scissors

* *Klin. Monatsbl. f. Augenheilkunde.* Bd. II, p. 497.

vertically downwards from the point of entrance of the knife towards the lower fornix, and through this vertical incision the conjunctiva is undermined by scissors and separated from the sclera over the whole area between the edge of the cornea and the lower fornix, extending as far round as the counter-puncture. A large pocket is thus made as in McReynold's operation for pterygium (*q. v.*) but extending further round the cornea. One blade of a blunt-pointed pair of fine scissors is introduced through the puncture into the anterior chamber, and the other blade is passed into the pocket. By a series of short snips the sclero-cornea is divided all round its circumference as far as the counter-puncture, the section being entirely subconjunctival. By pressure on the cornea above and counter-pressure below from within the pouch, by means of two spoons, the lens is pressed out into the pocket and then removed. Irrigation may be done if necessary. The incision in the conjunctiva may be closed with a silk suture. If it is considered desirable to do the operation with an iridectomy the incision is made upwards. If the capsulotomy has not been made by the knife, a cystitome is passed in after the completion of the section, and the capsule divided in the usual way.

Accidents :—Hæmorrhage from the free separation of the conjunctiva is the commonest accident met with and adrenaline is used to lessen this. Most of the accidents met with in ordinary extraction may be met with and need not be again referred to here.

After-treatment :—As after extraction.

CHAPTER VIII.

OPERATIONS ON THE CONJUNCTIVA.

PTERYGIUM—SYMBLEPHARON—CONTRACTED CONJUNCTIVAL SAC—TRANSPLANTING—SUBCONJUNCTIVAL INJECTIONS.

Pterygium.

Indications :—When the pterygium is growing over the cornea, its extension to the pupillary area is only a matter of time, and the operation should be performed without waiting for this to happen. The traction of the growth causes a certain amount of astigmatism which will be partly but not entirely removed by operation. When once the pterygium has encroached upon the cornea in front of the pupil, its removal never leads to complete restoration of the former degree of sight, partly on account of the astigmatism set up and partly because a scar is left on the cornea. For these reasons the operation should not be delayed, but done as soon as, by observation, the growth is found to be spreading towards the pupil.

These remarks apply with less force to false pterygia which are the result of inflammation. These are stationary but are unsightly and by their contraction cause astigmatism. Diplopia is also set up in cases of extensive pterygia, true or false, and may cause much inconvenience, forming an additional indication for early operation.

Instruments :—Speculum (fig. 8), fixation forceps (fig. 9), small scalpel, straight blunt-pointed strabismus-scissors (fig. 101), curved and straight suture needles (fig. 46), needle-holder (fig. 47 or 48), fine black silk.

Anæsthesia :—Local, with adrenaline.

Methods :—1. *Excision and suture*.—After insertion of the speculum and irrigation of the sac with some

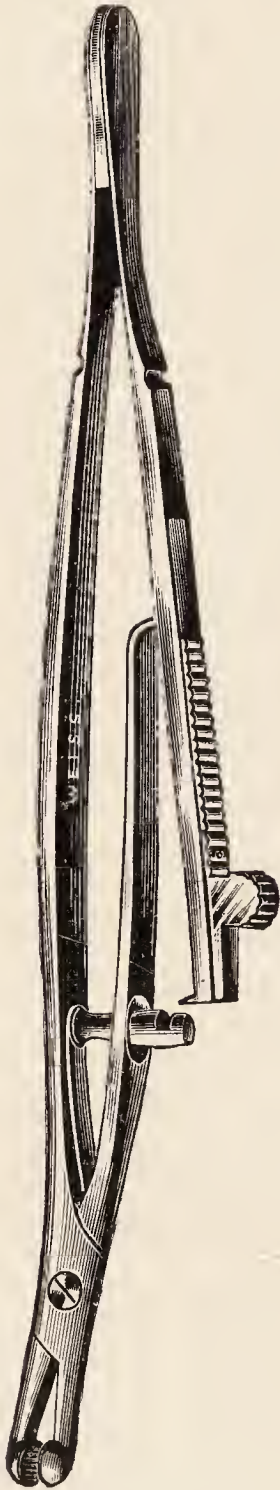


FIG. 47. — Weiss's needle-holder.

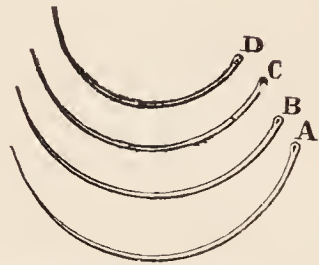


FIG. 46.—Suture needles.



FIG. 48.—Galezowski's needle-holder.

antiseptic lotion, the pterygium is grasped by the fixation forceps at its neck over the sclero-corneal margin and lifted up from the globe. The scalpel, which should be quite thin—a Graefe's cataract knife does very well—is then used to shave off the growth from its adhesion to the cornea.

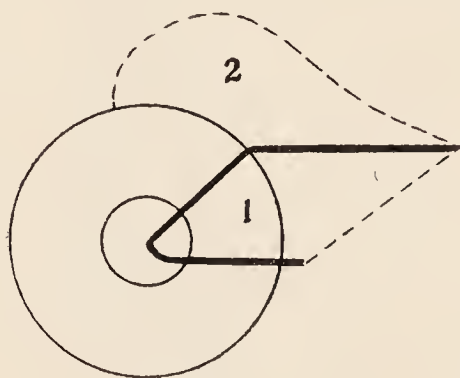
This will be best accomplished by passing the point of the knife under the neck of the growth from above or below, and cutting towards the apex. The separation must be complete, and it is better to remove some corneal epithelium with it rather than leave any of the pterygium on the cornea. The tongue-like flap is now dissected up towards the inner or outer canthus and may be removed by scissor-cuts above and below converging on the canthus. The wound thus left is diamond-shaped. The triangular raw surface on the cornea is left uncovered. The other triangular area on the sclera is now covered up by first undermining the conjunctiva above and then below with scissors, and drawing the edges together with one, or more often two, sutures. These are of black silk so as to be readily seen, and the ends are left long for easy removal on the third day after operation.

2. *Transplantation*.—In this the growth is not excised. After the tongue-like pterygium has been dissected up in the manner already described, it is transplanted downwards into a pocket beneath the conjunctiva (McReynolds).* Grasping the apex of the pterygium with fixation forceps it is put on the stretch, and the conjunctiva along the lower edge of the pterygium (not the upper) is divided with scissors almost as far as the canthus. The lower edge of the wound thus made is seized with forceps, and scissors are then passed into the opening from above, and the conjunctiva is separated from the globe over an area lying below and internal to the cornea, until the undermined area is a little larger than the tongue-like flap of pterygium (figs. 49 & 50).

Into the pocket thus made the flap is drawn in the following manner. A black silk suture about 8" long is

* *J. of Amer. Med. Assoc.*, 9th August 1902.

threaded with a needle on each end, and the needles are passed through the apex of the pterygium close together, and from the mucous towards the raw surface. These needles are then passed into the conjunctival pocket parallel to each other and brought out through the conjunctiva almost immediately below the centre of the cornea about $\frac{1}{4}$ " apart. By drawing on the sutures the apex of the flap is drawn into the pocket and by tying them it is fixed in position. This operation is satisfactory



Transplantation of pterygium (as seen by the operator).

FIG. 49.—1. Pterygium; thick line showing line of its separation from cornea and scissors cut along its lower edge.

2. Outline of pocket beneath conjunctiva to receive pterygium.

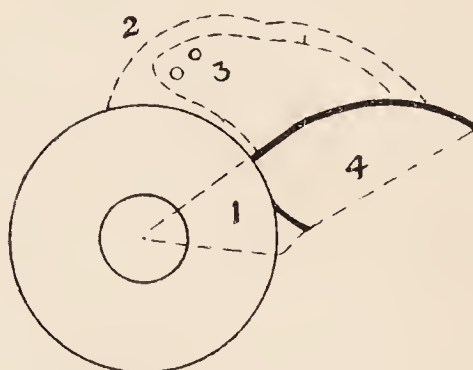


FIG. 50. 1. Raw area on cornea left uncovered.

2. Outline of pocket into which the pterygium, 4, is drawn, and fixed by two sutures 3, through its apex.

as regards freedom from recurrence, but it leaves a good deal of puckering and unsightly thickening and is unsuited for fleshy pterygia. These are better dealt with by excision or by Knapp's method of dividing the pterygium into an upper and lower half by a horizontal section after dissecting it up. The two halves are then transplanted into pockets prepared above and below as in McReynolds' operation, and the wound closed by bringing the edges of the undermined conjunctiva together with sutures. This also leaves much thickening; when the pterygium is very fleshy excision is decidedly the better operation.

Accidents :—None are likely to occur, but in some subjects considerable subconjunctival ecchymosis may result, causing an unpleasant appearance for several days and annoyance varying with the æsthetic equation of the patient.

After-treatment :—If both eyes are bandaged for 24 hours, rest is more complete. The pads should be removed and the eye washed daily, one eye only being bandaged after the first day. The stitches may be removed, under cocaine and with the use of a speculum, on the third day ; and a shade put on on the fourth, after which daily washing with simple boracic lotion may be continued as long as there is injection or any discharge.

Symblepharon.

Indications :—Adhesion of the bulbar and palpebral conjunctival surfaces following burns, wounds, ulcers, trachoma, etc.

Instruments :—Two pairs fixation forceps, Spencer Wells' forceps (for holding the two ends of a suture if necessary), blunt-pointed scissors, dissecting forceps, curved suture needles, needle-holder, coloured silk thread, grafting razor, lead foil or dentist's gutta-percha, fine file.

Anæsthesia :—Local with adrenaline. If the operation is an extensive one, a general anæsthetic may be advisable.

Methods :—The choice depends on the extent of the adhesions. False pterygia have already been dealt with. Small adhesions are cut through with scissors, and the raw area covered with a flap turned down from the adjacent healthy bulbar conjunctiva and stitched into position. If the raw area is large, it may be grafted with mucous membrane taken from the inside of the lip, or by skin grafts from some, as far as possible, non-

hairy part of the body by Thiersch's method, or by mucous membrane taken from the roofs of the mouths of frogs (Paton) or the pharynx of rabbits.

Larger adhesions, when more or less of the lid—usually the lower—is adherent to the globe, require more extensive operation, and until recent improvements in technique were almost uniformly unsatisfactory. Thiersch's large skin grafts are usually required, though mucous membrane from the mouth may suffice. Two conditions are necessary for success,* the transplanted flap must be fixed well down into the fornix and it and the eyeball must be fixed firmly so that no movement of either upon the other is possible. To fulfil both these conditions the method of Hotz is the best. For the lower lid, a plate of thin lead—or, as suggested by Weeks, one of dentist's gutta-percha—is cut out in half moon shape to fit the lower part of the conjunctival sac. After its edges have been made smooth, fine holes are made along its upper edge. The adhesions are freely divided and all cicatricial tissue removed and the plate inserted and trimmed so as to fit accurately. A graft is next shaved off the inner smooth surface of the patient's arm, previously sterilized. While the lower lid is now kept inverted the graft is floated in normal saline solution off the razor into its place, and its upper border is fixed to the conjunctiva on each side of the cornea by two sutures. The flap is smoothed down over the globe, the plate put in (sterilized of course) and the graft smoothed over the inner surface of the lid, care being taken that the edge does not turn in anywhere. The lid and plate, with the flap enclosed, are now taken in the finger and thumb of

* *Ophthalmic Review*, Vol. XXIV, p. 259.

the left hand, and a suture is passed through the central hole in the plate and brought out on the surface of the lid. This is tied, and similar sutures are passed through the remaining holes on either side of the centre. The immobility is perfect. The eye is bandaged for three days and the plate left in a week.

In the upper lid a circular plate is necessary, made so large that the lids can just close over it. A hole, the size of the cornea, is cut in it. The graft is not sutured, but the lids are sewn together for four or five days. The plate is kept in for a week and may then be taken out daily to be cleaned.

Operation for contracted conjunctival sac.

Indications :—When the sac has become too small to hold an artificial eye—as after enucleations or eviscerations, where much or the whole of the conjunctiva has been removed.

Instruments :—As for symblepharon, with the addition of glass beads.

Anæsthesia :—Chloroform is generally necessary.

Methods :—Grunert's operation is the best.* Two incisions in the conjunctiva are made parallel to each lid and as near their edges as possible, care being taken to leave a large central island of conjunctiva. This will not be possible in cases of ankyloblepharon and where the whole sac has gone. Both lids are freed so that they can be fully everted. To make complete eversion more easy, a horizontal incision is carried through the outer canthus, or, if still greater eversion is required, two diverging incisions beginning at the outer canthus may be employed, one going up and out, the other down and out. The lids

* *Ophthalmic Review*, Vol. XXIV, 1905, p. 259.

are then well everted, the upper one stitched to the shaved eyebrow, and the lower to the cheek. Several sutures, each armed with two needles, are employed. The needles are entered close to the edge of the lid on its inner surface, and after passing deeply through the skin, are tied over glass beads. The lids are not only to be everted as far as possible, but should also be stretched horizontally. When all bleeding has ceased, two very thin Thiersch's skin grafts are taken from the inner surface of the arm and laid on, large enough to cover the raw surface of the lids as well as the space produced by dividing the outer canthus.

In this operation the grafts are laid on a healthy vascular surface, and as the lids are everted over bone, the grafts are well supported and can be kept immovable and well pressed down upon the surface to which they are to be united. The centre is the only part unsupported, but this does not matter if a large enough island has been left. After two, or at most three, weeks the outer canthus can be reunited. A V-shaped flap is formed by two incisions passing outward from the end of each lid and meeting in a point. The flap is dissected up, a glass eye put in which partly covers the flap, and the edges of the V united. This not only brings the lids into their former position, but also forms a fornix to the outer side.

Transplanting.

Indications : —Transplanting of conjunctiva is required to form a firm cicatrix after wound of the cornea or sclera ; to strengthen the cicatrix in the healing of an ulcer if it be large or weak and yielding, or if iris has prolapsed through or into a perforation in it.

Instruments :—Speculum, fixation forceps, blunt-pointed scissors, spatula, probe, iris forceps, curved suture needles, coloured silk.

Anæsthesia :—Local, with adrenaline.

Methods :—If the wound be in the sclera, the prolapsed uvea may be replaced, if that is possible, after careful cleansing, or if not possible, it must be cut off with scissors. The conjunctiva is then undermined on either side of the wound and the edges of it drawn together with sutures passed in some distance from the edge, so as to firmly close the scleral wound.

If the wound or ulcer is in the cornea, one of two methods may be adopted to obtain sound healing. *Pinto's* method is also an attempt at preventing adhesion of the iris to the cornea. In it the prolapsed iris is drawn slightly out of the wound or ulcer, and snipped off with scissors. A spatula is passed in to separate the iris from the edges of the wound, and then a flap cut from the bulbar conjunctiva is transplanted on to the opening in the cornea. The flap should be considerably larger than the opening, into which it is pushed by a probe. The eyes are bandaged for three days. The excess of flap shrinks and a firm cicatrix results with sometimes a restored anterior chamber. In *Kuhnt's* method a columnar-shaped strip of conjunctiva—varying in width according to the size of the ulcer—is raised at the side of the cornea nearest to the ulcer. It is dissected free from the globe except at either end. The flap thus fashioned with a double pedicle is drawn over the cornea and fixed in position by one or two sutures, so that its raw undersurface lies on the wound or ulcer, to which it becomes adherent. If a single pedicle is preferred, a conical flap can be raised, turned on its pedicle and sewn to the conjunctiva on the opposite

side of the cornea, so that the ulcer is well covered by it.

After-treatment :—The eye requires to be bandaged with daily dressing until the flap has healed well. Any stitches used may be removed on the third or fourth day.

Subconjunctival injections.

Indications :—Various inflammations and diseases of the cornea, especially interstitial keratitis, inflammations of the chorioid, retina and optic nerve, detachment of the retina and opacities of the vitreous. Numerous substances have been used for injection, sublimate 1 in 2000, cyanide of mercury 1 in 5000, salt 5 p. c., sodium cinnamate (hetol) 1 p. c., iodipin 10 p. c. Of these the most generally useful are the sterilized saline solution 2 to 10 per cent., and the cyanide of mercury 1 in 5000 of 2 p. c. salt solution. Five minims of a one per cent. acoine solution, added to the 15 m. in the syringe, relieve the pain of the injection, but it has been asserted that the acoine leads to the formation of denser adhesions between the conjunctiva and sclera than result from simple saline or cyanide injections. As acoine is precipitated by salt solutions, it must be injected immediately when prepared, or the needle may become blocked.

Instruments :—Speculum, fixation forceps, glass syringe (m. xx) with platino-iridium needle.

Anæsthesia :—Local.

Method :—After cleansing of the conjunctival sac, insertion of the speculum and fixation of the globe, the needle is inserted under the conjunctiva, which is raised by a pair of fixation forceps pointing away from the centre of the cornea at a point a quarter of an inch behind the limbus, and pushed onwards in the subconjunctival tissue

for about a quarter of an inch. Ten minims of the solution are then slowly injected, the conjunctiva gradually bulging forward as the injection is made. The needle is then withdrawn, gentle massage is applied through the lid over the swelling after removal of the speculum, and a bandage put on.

Accidents and their treatment :—If care is not taken, a vein may be punctured and considerable ecchymosis result. Necrosis has resulted from sublimate injections, especially when made near the sclero-corneal junction, where the subconjunctival tissue is scanty. Slight discolouration and œdema remain for some days and the eye is not usually fit for another injection until a week later. If the pain is very severe, hot fomentations may be applied or morphia may be necessary.

After-treatment :—The bandage may be kept on until the œdema has subsided and daily gentle massage will assist the action of the injection unless contra-indicated by the nature of the disease for which it was given (*e.g.*, detached retina).

CHAPTER IX.

OPERATIONS ON THE CORNEA.

EXAMINATION OF CORNEA—REMOVAL OF FOREIGN BODIES
—SCRAPING ULCERS AND APPLICATION OF CAUTERY
AND ANTISEPTICS—SÆMISCH'S OPERATION—PARA-
CENTESIS—TATTOOING — PERITOMY — TRANSPLANTA-
TION—STAPHYLOMA.

Examination of Cornea.

FORCIBLE opening of the lids must be avoided. Blepharospasm may often be relieved by instillation of cocaine. The lower part of the cornea can be easily examined, the upper not so. An attempt to raise the upper lid often results in the patient looking strongly upwards and successfully concealing the cornea. It is better, after instilling cocaine, to raise the upper lid only very slightly and to persuade the patient to open *both* eyes and look down at some definite object. While doing so, the lid may then be gently raised as desired. Should the patient begin to look up, the lid should at once be let go and the process repeated until his confidence is obtained. In the case of a child, matters are more difficult still. When a child is held up in the mother's arms and told to look toward the surgeon, *i.e.*, away from the mother, his first instinct on feeling the eye touched is to turn away from the surgeon and bury his face in the mother's shoulder. If the mother be turned round so that her back is half turned to the examiner and the child looks at him over

her shoulder (the one nearer to him), the examination is easier as the child feels more safe and will not try and turn away as before. If then an assistant or the mother supports the child's head from behind, the surgeon can often obtain a good view of the cornea by quickly pressing the lids apart with his two thumbs, rolling the

edges of the lids *in* at the same time. Failing to do so, two courses are open to him, one is to sit facing the mother, who sits and holds the child up to her, face to face, with the legs round her waist. She then lowers the child backwards towards the surgeon, holding the arms with her hands and the legs against her waist with her elbows, until the surgeon grasps the head firmly, but gently, between his knees covered by a towel. When the child has been thus rendered immovable, a retractor is inserted and the upper lid raised by it, the lower being

drawn down by the thumb of the other hand ; or a speculum may be used instead to expose the cornea. The other course is to give a general anæsthetic, as in all cases of corneal disease a good view of it must be obtained at the first visit. This is necessary to enable a satisfactory diagnosis and prognosis to be made, as well as to determine the proper treatment.

Removal of Foreign Bodies.

Instruments :—Speculum, fixation forceps, dissecting forceps, Graefe's knife, spud (fig. 51), probe, small Volkmann's spoon (fig. 52), corneal loupe.



FIG. 51.—Spud.



FIG. 52.—Sharp spoon.

Anæsthesia :—Local, in children a general anæsthetic is advisable, as the necessary self-control is wanting.

Method :—With a small foreign body, merely adherent to the cornea, the speculum need not be used and the patient may sit in a chair, the head leaning back against the surgeon's chest. The lids may be held apart by the thumb and index finger or two fingers, after anæsthetization, and the foreign body removed with the spud held in the right hand (fig. 53). Focal illumination and the use

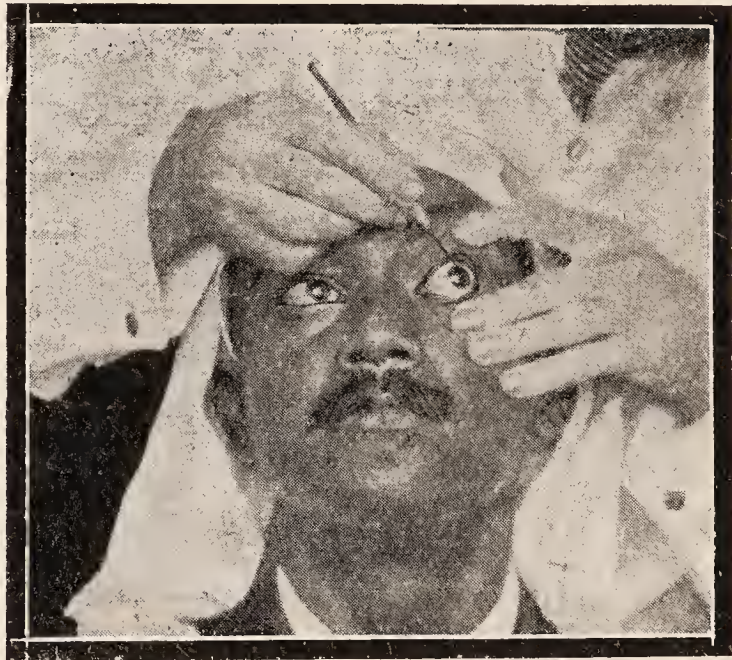


FIG. 53.—Removal of foreign body from cornea by spud.

of a corneal loupe—Berjeau's stereoscopic for choice fixed on the surgeon's head—are of much assistance in seeing and removing foreign bodies with a minimum of injury to the corneal epithelium. The patient must gaze steadily at some chosen point to prevent movement of the globe. If unable to do this, the globe may require fixing with forceps. With a foreign body more deeply imbedded, the patient should be lying down and a speculum inserted. The fixation forceps may be used, seen through the loupe, to seize hold of and withdraw the foreign

body. If too small to be seized, it may be removed by raising it with the spud or the tip of a Graefe's knife. If it is fixed in the deeper layers of the cornea and there is danger of its being pushed through into the anterior chamber, a Graefe's knife should be passed into the chamber and withdrawn, and a probe passed in and held against the cornea to support it, while the foreign body is dissected out and removed with the knife. If there is any staining of the cornea from rust, it should be scraped away with the Volkmann's spoon. This should also be used in cases where ash of any kind has entered the eye and adhered to the cornea. Tobacco ash is particularly injurious, and ash from wood or coal is little less so. Quite a small particle is capable of keeping up irritation for long periods until removed by scraping.

After-treatment :—The wound left after removal of the foreign body should be carefully cleaned by swabs of wool soaked in mercuric iodide lotion (1 in 5000), and after the insertion of sterilized castor oil, or iodoform ointment (gr. x to $\bar{3}$ i) the eye should be bandaged and kept so, being washed and dressed daily, until the epithelium is healed over. If the foreign body has been deeply imbedded and difficult to remove, or the anterior chamber opened, atropine should be instilled. A combination of cocaine (alkaloid) with the iodoform ointment (gr. iv to $\bar{3}$ i) helps to relieve pain.

Scraping ulcers and application of cautery and antiseptics.

Most corneal ulcers are the result of infection by micro-organisms, staphylococci, streptococci, pneumococci, Morax-Axenfeld bacilli, etc., and in such ulcers some of the measures now under consideration are required. In

the ulcers occurring during gonorrhœal ophthalmia, after the instillation of cocaine, the ulcer may be carefully wiped over with a swab of absorbent cotton wool dipped in pure tincture of iodine. This is also useful in ulcers following phlyctenules, especially those forming marginal ring ulcers and in facettèd ulcers. In serpiginous (Sæmisch's) ulcer the pneumococcus usually present may be destroyed by the application of pure carbolic acid ; after the undermined margin has been cut away with fine scissors or scraped.



FIG. 54.—Cautery.

In Mooren's 'rodent' ulcer, any of these antiseptics may be used or absolute alcohol may be applied on a pointed swab. Sir Henry Swanzy introduced the treatment by absolute alcohol, and in such cases and in dendriform keratitis (for which he first used it) it is without doubt an excellent method of treatment. The application which is painful, even under cocaine, should be confined to the ulcerated area and the alcohol washed off with sterilized normal saline solution. In deep infected ulcers, serpiginous and 'rodent' ulcers the applications of antiseptics as described above may be tried if the cases are not very severe or are seen early, otherwise the actual cautery is necessary.

A galvanocautery may be used, or Weiss's small bulbous actual cautery (fig. 54) heated in a spirit lamp, or failing that an ordinary probe heated to red heat. The actual cautery may be applied to some dry wool to test its temperature. If the wool scorches, it is hot enough.

Chronic ulcers may be curetted with a sharp and small Volkmann's spoon.

In all these measures for the treatment of corneal ulcers an instillation of fluorescine should first be made

(fluoresceine gr. x, carbonate of soda gr. iv, distilled water 1 fl. oz.). If the eye be kept closed for a few seconds, the ulcerated area becomes stained a yellowish-green colour, and the limits of the area requiring the application are beautifully defined.

Sæmisch's Operation.

Indications :—Deep ulcers of the cornea about to perforate, especially the serpiginous variety.

Instruments :—Speculum, fixation forceps, Graefe's knife, spatula (fig. 55).

Anæsthesia :—Local.

Method :—After inserting the speculum and fixing the globe with fixation forceps, the point of the Graefe's knife is entered in healthy corneal tissue at one side of the ulcer, cutting edge forwards, perpendicularly to the corneal surface, passed through into the anterior chamber, and pushed on again so as to emerge through healthy corneal tissue at the other side of the ulcer. The knife is slowly made to cut out through the centre of the ulcer allowing the aqueous to escape as slowly as possible. However carefully this is done, the patient feels intense pain on account of the reduced pressure allowing distension of the iridic vessels and stretching of the inflamed tissues. The speculum is then removed, atropine instilled,—best in the form of an ointment with iodoform—and the eye bandaged. Should the hypopyon, which is usually present, reform after evacuation, the wound may be re-opened daily with a probe.



FIG. 55.—Spatula.

Paracentesis.

Indications :—In any deep ulcer of the cornea threatening to perforate, especially in marginal phlyctænar ulcers, and in ulcers complicated by increase of tension or hypopyon ; after cauterization of a serpiginous ulcer in order to prevent perforation ; to remove hyphæma ; to assist in the diagnosis of a foreign body ; in irido-cyclitis with increased tension ; in von Graefe's method of treating keratococcus, in which an ulcer is produced at the apex of the conical cornea and the aqueous is then evacuated through the floor of the ulcer ; in artificial ripening of cataract where paracentesis is first performed and then the lens is massaged through the cornea ; in embolism of the central retinal artery paracentesis is combined with massage of the eyeball.

Instruments :—Speculum, fixation forceps, paracentesis needle, keratome or Graefe's knife, spatula, iris forceps.

Anæsthesia :—Local.

Method :—After inserting the speculum and fixing the globe, the knife or needle is passed into the anterior chamber near the margin of the cornea—parallel to the plane of the iris. As soon as the point is well within the anterior chamber, it is tilted forwards towards the cornea, so as to avoid damaging the anterior capsule of the lens. The aqueous is allowed to escape slowly as the knife is withdrawn.

Accidents :—Wound of the lens is avoided by tilting the knife point forward before the aqueous escapes. Iris prolapse is guarded against by allowing the aqueous to escape slowly. Should it occur, the prolapsed portion is replaced by means of the spatula, and this failing, it must be cut off with scissors.

After-treatment :—Atropine or eserine according to the indications of the case, pad and bandage. Re-opening the wound may be required if there is severe pain or the healing process is not rapid, and may be accomplished by passing in a probe under cocaine.

Tattooing.

Indications :—To render a dense white scar less disfiguring ; to convert a nebula into a leucoma and so prevent irregular refraction of light through it which blurs all images ; when this is stopped by the tattooing the rays passing through the natural pupil, or through the coloboma if an iridectomy is rendered necessary by the position of the leucoma, then form clear images of objects on the retina and vision is much improved.



FIG. 56.—Tattooing needles.

Instruments :—Speculum, *not* fixation forceps, tortoise-shell spoon, a bundle of six ordinary sewing needles tied together with the points all level, or Weiss's instrument (fig. 56), Indian ink, lamp-black.

Anæsthesia :—Local. General is necessary in children.

Methods :—The eyelids being held apart with the fingers or with the speculum, the surface of the leucoma is penetrated slantingly all over by the needle points. The Indian ink, which has been mixed with a drop or two of sterile water in a China spoon, or the hollow bottom of a glass medicine-glass, into a thick paste, either alone or mixed with lamp-black, is then rubbed into the perforated surface with the back of the tortoise-shell spoon. The excess ink is rubbed off with a wet swab and the process

repeated until the tatooing is considered to be done enough. This is a better way than first covering the leucoma with ink and then tatooing, as the exact area to be coloured is seen much better and the clear cornea is left untouched. The tatooed area is finally left covered with a thick layer of the ink paste, and the eye bandaged. Fixation forceps must on no account be used or the conjunctiva will also be marked. De Wecker's grooved needle acts no better than the bunch of needles used thoroughly, and with it there is danger of perforation of the cornea through into the anterior chamber. The operation generally requires to be repeated after a time.

Accidents :—Penetration of the anterior chamber has just been referred to, but is not likely to happen if the sewing needles are used. Unnecessary tatooing of clear cornea is also avoided by not applying the ink until the punctures have been made. If the eyeball is steadied by the fingers instead of the forceps as it should be, tatooing of the conjunctiva is avoided.

The reaction is considerable, but if care is taken not to tatoo eyes that are not absolutely quiet, it should not reach a dangerous degree. Cases of thin yielding scars of the cornea are not of course suitable. Sterilization of the needles and fluid used to make the paste are necessary.

After-treatment :—It is generally advisable to instil atropine after the operation and to keep the eye bandaged for a couple of days. A shade may then be worn until any inflammation set up has subsided. If an iridectomy is required, it should be done after the tatooing, not before, as the wound leaves a weak place in the globe which will not withstand the pressure required in tatooing for a long time afterwards.

Peritomy.

Indications :—In the treatment of vascular pannus.

Instruments :—Speculum, fixation forceps, blunt-pointed scissors.

Anæsthesia :—Local, with adrenaline.

Method :—After insertion of the speculum the conjunctiva is seized by the forceps and cut through by the scissors in a curved line, running parallel to the corneal margin, and situated about $\frac{1}{4}$ " distant from the limbus. The narrow strip of conjunctiva between this incision and the cornea is then dissected up and cut off as close to the cornea as possible. This leaves a raw surface about $\frac{1}{4}$ " broad running all the way round the cornea. In mild cases less may be removed and if there has been much shrinking of the bulbar conjunctiva due to the trachoma, it is better to be content with the incision only, dividing the vessels supplying the pannus, and to omit the excision of conjunctiva altogether. In healing, the wound cicatrization helps to further diminish the blood supply to the pannus.

Accidents :—The removal of too much tissue is to be avoided as has just been mentioned. Excessive hæmorrhage and infection are avoided by the use of adrenaline and antiseptics.

After-treatment :—The eye requires a pad and bandage for a few days and daily cleansing. The wound heals in about a week and improvement in the pannus may then be expected to begin.

Transplantation.

Indications :—In leucoma of the cornea from ulceration, burns or injury, where the deeper structures are not

seriously damaged, *i.e.*, where the opaque cornea alone is the cause of loss of sight.

Instruments :—Speculum, fixation forceps, blunt-pointed scissors, von Hippel's trephine (fig. 57).

Anæsthesia :—General anæsthesia is necessary.

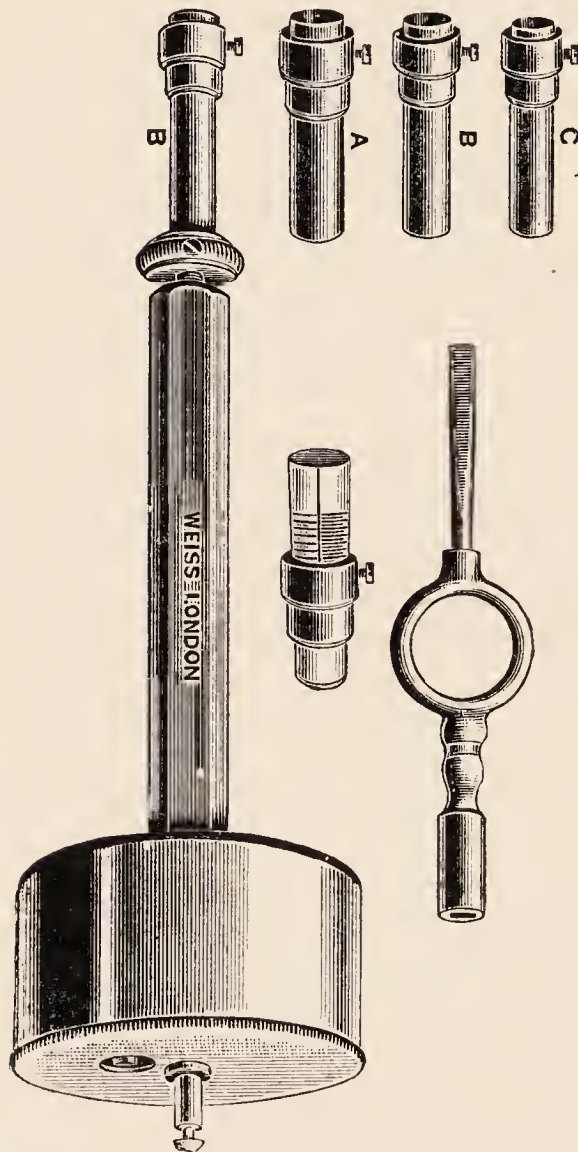


FIG. 57.—V. Hippel's trephine.

form and transplantation is at once carried out. The first step is the formation of a conjunctival bridge below the leucoma. A disc of cornea is removed by von Hippel's trephine from the clear cornea of the enucleated

Method :—As Zirm* has succeeded at last in transplanting a cornea and obtaining vision which has continued over a year and improved (up to $\frac{6}{38}$? and J. 6), where other surgeons have all failed, it is worth while giving a short description of his method and the reasons given for his success. The graft is to be taken from a young healthy human eye ; therefore one enucleated for injury is the one most likely to prove satisfactory as in his case. The eye is at once immersed in warm normal sterile saline solution. The leucoma patient is also under chloro-

* Graefe's *Archiv. für Ophthalmologie*, LXIV, 3. *Ophthalmic Review*, 1907, Vol. XXVI, pp. 3 and 163.

eye and immediately wrapped in gauze, squeezed out of warm salt solution and kept warm and moist in a stream of aqueous vapour; this would be probably unnecessary in India. If the anterior chamber is present, eserine must be instilled. A disc is then removed from the patient's leucomatous cornea, and the corresponding disc of clear cornea is inserted in its place, care being taken not to breathe upon it or touch it with any instrument, except the trephine, from the beginning to the end of the operation. For the same reason asepsis and no antisepsis must be employed. The disc fits accurately and is fixed in position by stitching the conjunctival bridge over it.

Zirm considers that the nourishment of the graft comes from the margin through the tissue fluids and the vessels, and slightly from the aqueous humour by diffusion. Therefore cases which are likely to be successful are such as have leucomata in which some remains of the original corneal texture, especially of the deeper portions, still exist. If the deepest portions are destroyed, transparency will not continue, and therefore one should select cases whose leucomata are due to burns, to the action of lime, to severe pannus and to superficial ulceration.

Staphyloma.

Indications :—If the staphyloma is total, enucleation or one of its substitutes (Mule's operation, etc.), will be required, but if partial, less serious measures may be adopted. Should any clear cornea and an anterior chamber remain, an iridectomy will reduce the tension and prevent further bulging of the staphyloma and in favourable cases even restore sight. Should iridectomy not be possible and the sight be lost, the staphyloma may be removed by de Wecker's method, though, generally

speaking, such cases are better treated by enucleation or evisceration (*q. v.*).

Instruments :—Speculum, fixation forceps, sharp and blunt-pointed scissors, Graefe's or Beer's cataract knife, six suture needles, different coloured silk sutures.

Anæsthesia :—A general anæsthetic is necessary.

Method :—After insertion of the speculum the conjunctiva is incised as near the cornea as possible all round the limbus, and dissected up off the globe for nearly half an inch as in enucleation. Sutures (4 to 6) are passed through the edges of the conjunctival opening thus formed from above downwards, the loop of each drawn out from within and the ends and loops laid aside so as not to be cut during the ablation of the staphyloma

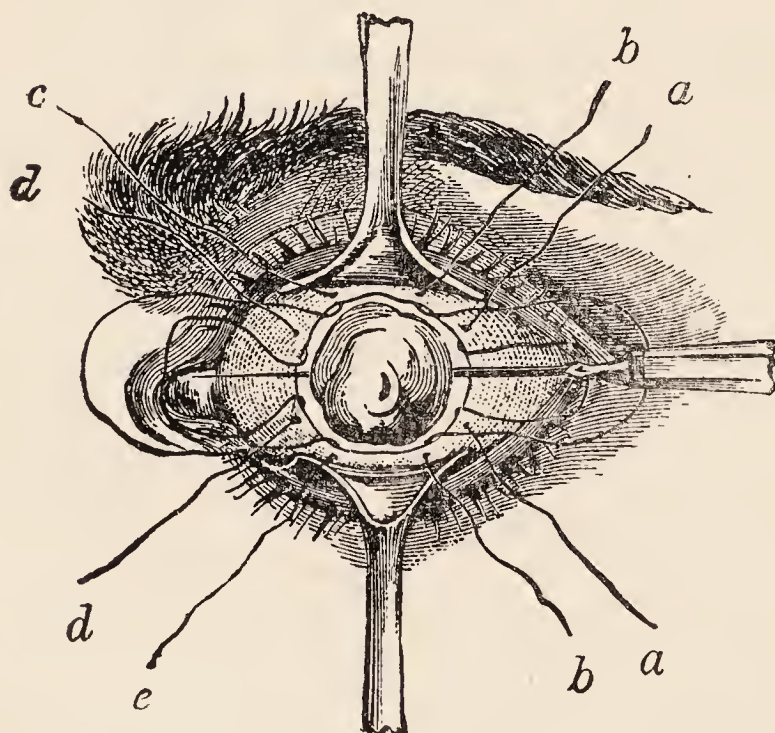


FIG. 58.—Ablation of staphyloma (Swanzy).

(fig. 58). This is then carried out by transfixing it across its centre with a Graefe's or Beer's cataract knife and cutting out towards the upper lid with the flat of the knife parallel to the plane of the normal iris. The lower half of the

staphyloma is then cut through by scissors. If the lens is seen, it is removed, and the sutures are then tightened and tied, covering in the front of the eyeball with conjunctiva, and keeping the cut edges of the sclera in position. A tobacco-purse suture is useful instead of

the interrupted suture, and obviates some of the difficulties of the latter.

Accidents :—The ends of the sutures and the loops must be kept well away from the staphyloma, or they will be cut and the object of their insertion, *viz.*, rapid closure of the opening left, will be defeated. Serious hæmorrhage may occur at the time of operation or later, especially if tension was high, and in such cases the operation is better not attempted. The sutures must not be passed through the sclera as there is then danger of sympathetic ophthalmitis.

After-treatment :—As after enucleation.

CHAPTER X.

OPERATIONS ON THE LIDS.

EVERSION—TRACHOMA — TRICHIASIS — ENTROPION — EC-TROPION—BLEPHAROPLASTY—THIERSCH'S GRAFTING—CHALAZION—MEIBOMIAN INFARCTS—CANTHOPLASTY—TARSORRHAPHY — EPICANTHUS — PTOSIS — ELEPHANTIASIS.

Eversion.

THE lower lid is easily everted by pressing the pad of the thumb against its outer surface about the centre, and then drawing it downwards, telling the patient to look up. This brings the fornix well into view also.

The upper lid requires more skill and may be everted, using only one hand or using both. To do it with one hand the patient must look down. The surgeon facing the patient uses the right hand for the left eye and *vice versa*. The upper lid is grasped between the ulnar edge of the thumb, placed between the lids, and the tip of the index finger placed against the outer surface of the lid a little above and externally to its centre. By lifting the thumb and pressing the finger the lid is everted. It is easier and less painful if the patient looks well down.

In using both hands the lashes at the centre of the upper lid are seized with the thumb and index finger—of the right hand for the right eye—and the lid is drawn down and slightly away from the eyeball. The tip of the little finger of the other hand—or a probe or pencil—is

then pressed against the upper edge of the tarsus—in a direction towards the centre of the eyeball. The combined action of the two forces everts the lid and the palpebral conjunctiva comes well into view. To expose the transitional fold (fornix) the edge of the everted lid must be held backwards against the orbital margin by the thumb of one hand, while the globe is steadily pushed towards the apex of the orbit with the other thumb through the lower lid (fig. 59). The lower lid should

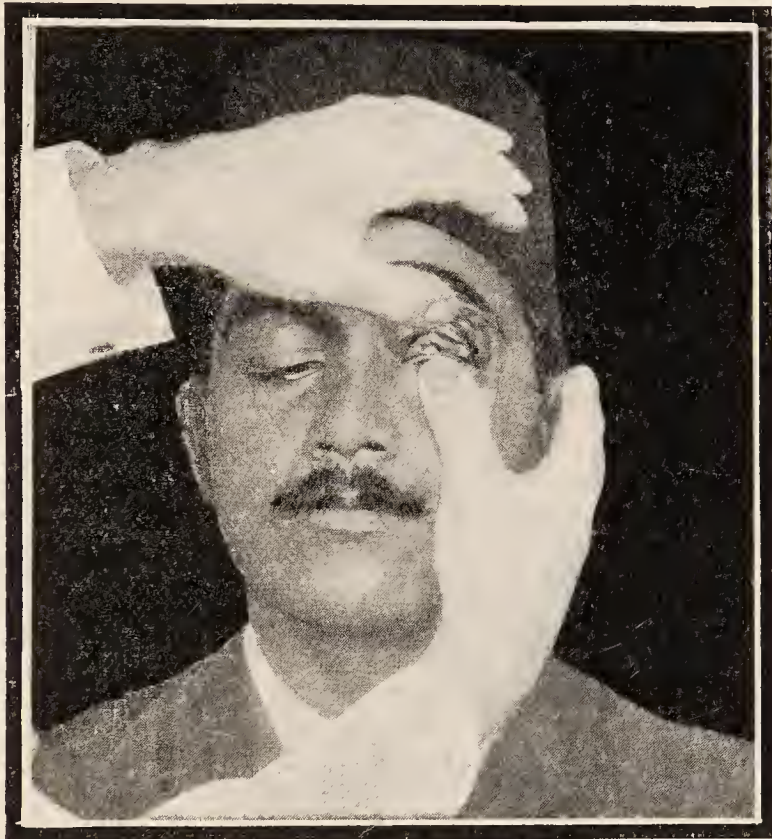


FIG. 59.—Double eversion of the upper lid.

be first slid up a little in front of the cornea by the thumb to enable the pressure to be correctly applied. With either method the patient's head should be supported from behind to prevent his withdrawing it during the operation.

Trachoma.

Indications :— When the 'granules' are well defined and ripe, *i.e.*, softened, *expression* by Knapp's roller forceps

gives good results. Before the follicles are ripe expression only does harm, and to be of use it must be done before cicatrization has begun. It may also be used with advantage in early cases of 'gelatinous' trachoma. In severe and advanced gelatinous cases roller forceps should not be used, mere gentle expression by pressure with Kuhnt's expressor, which is a forceps with two perforated square plates in which the holes do not correspond, being indicated. *Simple excision* is useful for trachoma confined to the fornices (1) when other methods have proved futile or on recurrence; (2) when the tarsus or bulbar conjunctiva is invaded; (3) in corneal complications; (4) in all individuals who come from a trachomatous horde and have to return to it again.* *Combined excision* is indicated in chronic cases which show no progress with medicinal treatment or easily relapse. Heisrath† excised: I, in less advanced chronic cases—(1) when the transitional fold tissue has become solid and thick and appears gelatinous and anæmic; (2) where as the result of the disease of the conjunctiva pannus has developed: it then suffices to limit the operation to the upper lid; and II, in old granular processes, (1) in those where the chief changes are in the upper tarsal conjunctiva; (2) in those with marked signs of inflammation, especially with hypertrophy of the conjunctiva affecting chiefly the fornix; (3) always when the cornea is already implicated, after removal of the faulty position of the lids.

Instruments :—Knapp's roller forceps (fig. 60), Graddy's forceps (fig. 61), Kuhnt's expressor. For

* J. Boldt: *Trachoma*. Translated by J. H. Parsons and T. Snowball. London: Hodder and Stoughton, 1904.

† H. Kuhnt: *Ueber die Therapie der Conjunctivitis Granulosa*. Jena 1897.

excision : a horn spatula two pairs of narrow pointed fixation forceps (with catches), one pair Wakley's fenestrated artery forceps, curved blunt-pointed scissors, six suture needles, black silk sutures.

Anæsthesia :—Local is generally enough except in children for whom general anæsthesia will be required. In excision subconjunctival injection of the anæsthetic will be required. General anæsthesia is better not used as it is important to be able to test the movements of the lids before the sutures are tightened up and tied.

Expression.

Methods :—The lid being inverted the transitional fold should be grasped in the expression forceps (Knapp's or Graddy's) which are then squeezed together and drawn along towards the free edge of the portion grasped (figure 62).

This squeezing process is repeated systematically from one end of the lid to the other. The conjunctiva should not be torn but enough pressure used merely to express the granules. The forceps should not be placed with one

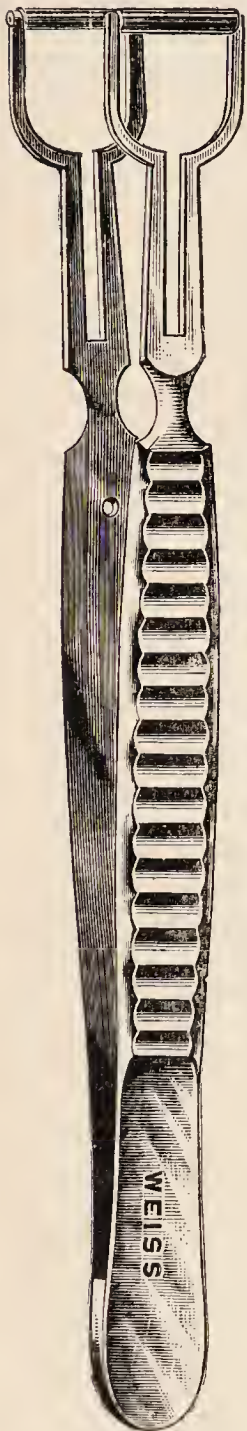


FIG. 60.—Knapp's roller forceps.

FULL SIZE

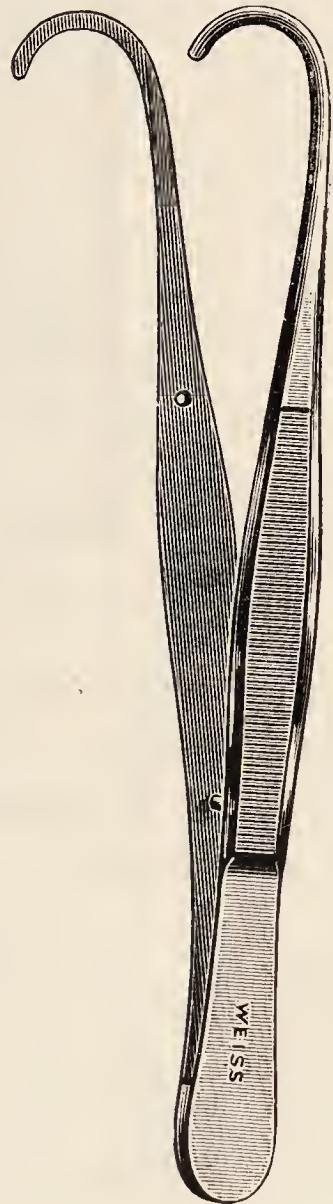


FIG. 61.—Graddy's forceps.

roller or limb inside the lid and the other outside on the skin surface, as is sometimes recommended, because the latter then becomes infected from the skin and subsequently may infect the conjunctiva. All four lids may be done at one time. The operator will be wise to wear goggles as the expressed material may travel far and infect his eyes.



FIG. 62.—Expression with Knapp's forceps.

*Accidents :—*Abrasion of the cornea is dangerous, but may easily be avoided with ordinary care. The same may be said of laceration of the conjunctiva. The expression should be gently not violently performed.

After-treatment.—Iced boric compresses are useful after the operation. The eyes may be bandaged for a few hours if there is much bleeding ; but bandaging is better omitted if possible. Treatment with sulphate of copper is usually advisable to complete the cure.

Simple excision.

With the patient lying down, the upper lid is everted, and an assistant, who stands at the head, seizes the prominent convex border of conjunctiva, brought

into view by the inversion, with two pairs of forceps applied one at either end of its middle third. He draws the conjunctiva forcibly upwards towards the upper orbital margin and the patient looks forcibly downwards (fig. 63). In this way the transition folds are drawn well out and can be easily explored. Where

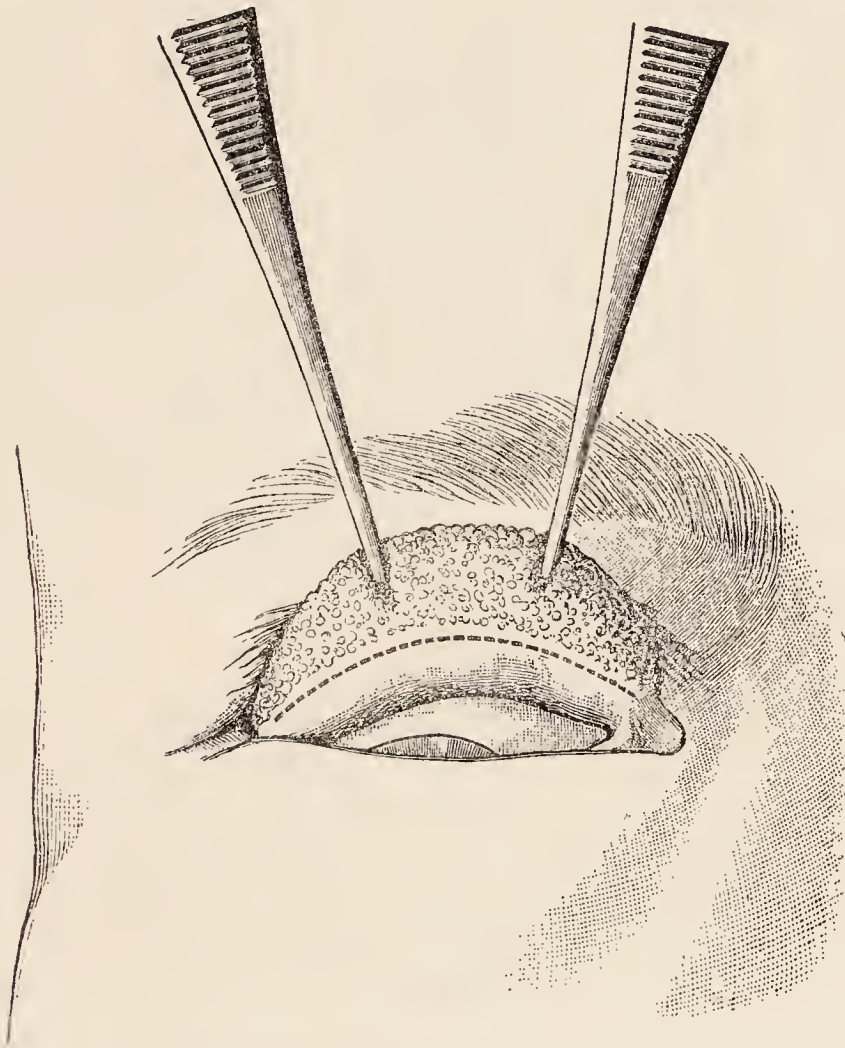


FIG. 63.—Kuhnt's operation for trachoma.

the diseased granular fornix is marked off from the healthy bulbar conjunctiva an incision is made, through conjunctiva only, from the inner to the outer canthus in length. Müller's muscle, shining red-blue, is visible usually in the bottom of the cut. Sutures—four usually—are passed through the bulbar edge of the conjunctival wound, not taking up more than 0.5 mm. of the tissue, and taking care to first evert the rolled-in edge of the

membrane with forceps, or more tissue will be taken up than is desirable. The bulbar edge of the wound is dissected up from the underlying tissues over an area 4 to 6 mm. wide. The sutures are held up towards the forehead out of the way while the next part of the operation is performed. A second incision is made separating the fornix from the tarsus, and is placed in healthy tissue. The area isolated by the two incisions is seized at its inner end with forceps and dissected off the underlying tissues with scissors. The sutures are carefully inserted through the tarsal edge of the wound, so that the two edges correspond accurately, and are tied. The eye is washed with mercuric iodide lotion 1 in 5000, and both eyes are bandaged.

In the lower lid the diseased area may be first mapped out with two incisions, or may be at once lifted up at one end by forceps, and then excised towards the other end by curved scissors.

Combined excision (Kuhnt).

The upper lid is everted and the *first* incision is made as in 'simple excision.' The separation from underlying tissues is carried deeper, and sutures are more liberally inserted ; less than half a centimetre apart. The forceps are then removed from the convex edge of the tarsus, and a horn spatula is introduced from above beneath the skin surface of the singly everted lid. The assistant holds this in one hand, and with the other seizes the centre of the lid margin with a single-pointed catch forceps and draws it up on the spatula, holding it there securely (fig. 64). This displays the whole palpebral conjunctiva equally supported everywhere on the spatula.

The amount of tarsus to be removed depends upon the extent of the disease, but the *second* incision must

never be placed less than 2·5 mm. from the lid edge. Great care must be taken also not to get the incision further away from the lid margin at either end, especially the temporal end, than at the centre, and so leave more diseased tarsus there than at the centre. This incision is made in one cut and joins the first at either end, and

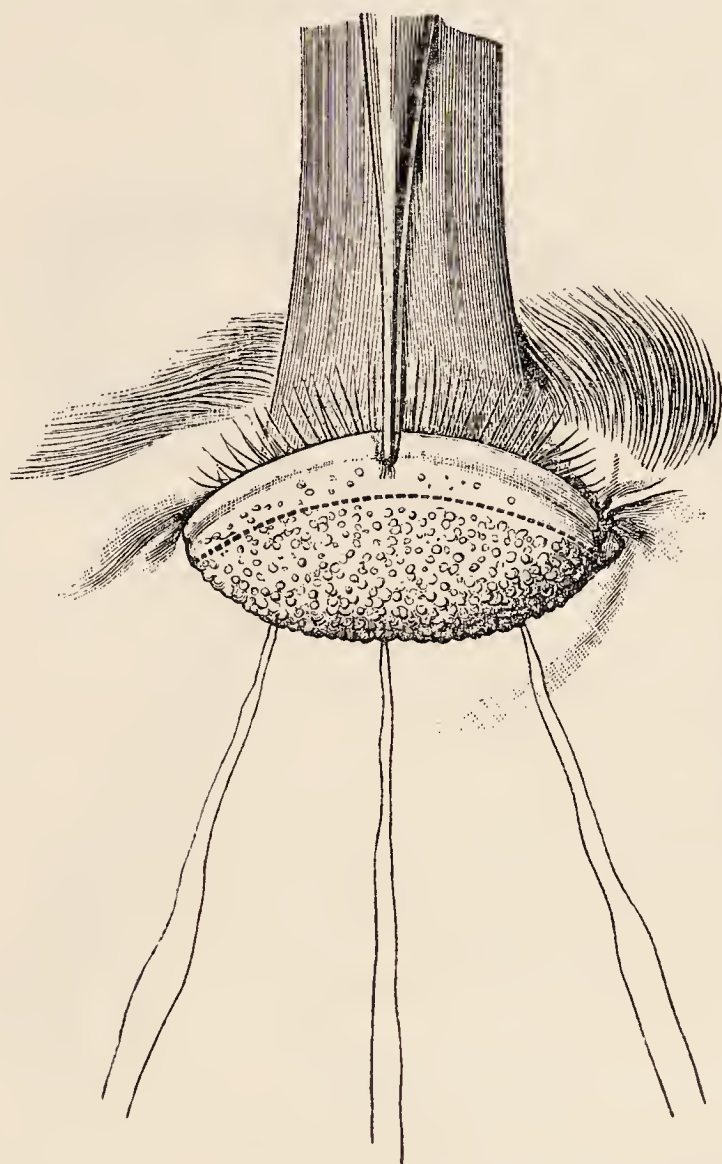


FIG. 64.—Combined excision in trachoma (Kuhnt).

the total area of diseased tarsus marked out by the two is then removed. One end of it—the nasal usually—is raised by forceps, after the horn spatula has been removed but not the lid-holding forceps, and by means of a series of short snips, the tarsus is dissected up with scissors without injury to the underlying orbicularis or Müller's muscles.

It now remains to close in the wound surface left, which of course is only possible by drawing over it the undermined bulbar conjunctiva. The edge of this must be very accurately sewn to the cut-edge of the remaining tarsus. The slightest irregularities cause bad cosmetic effects not easily got rid of. The best way to obtain a good result is to let the patient open and close the eye several times to see if the muscles work properly. Then

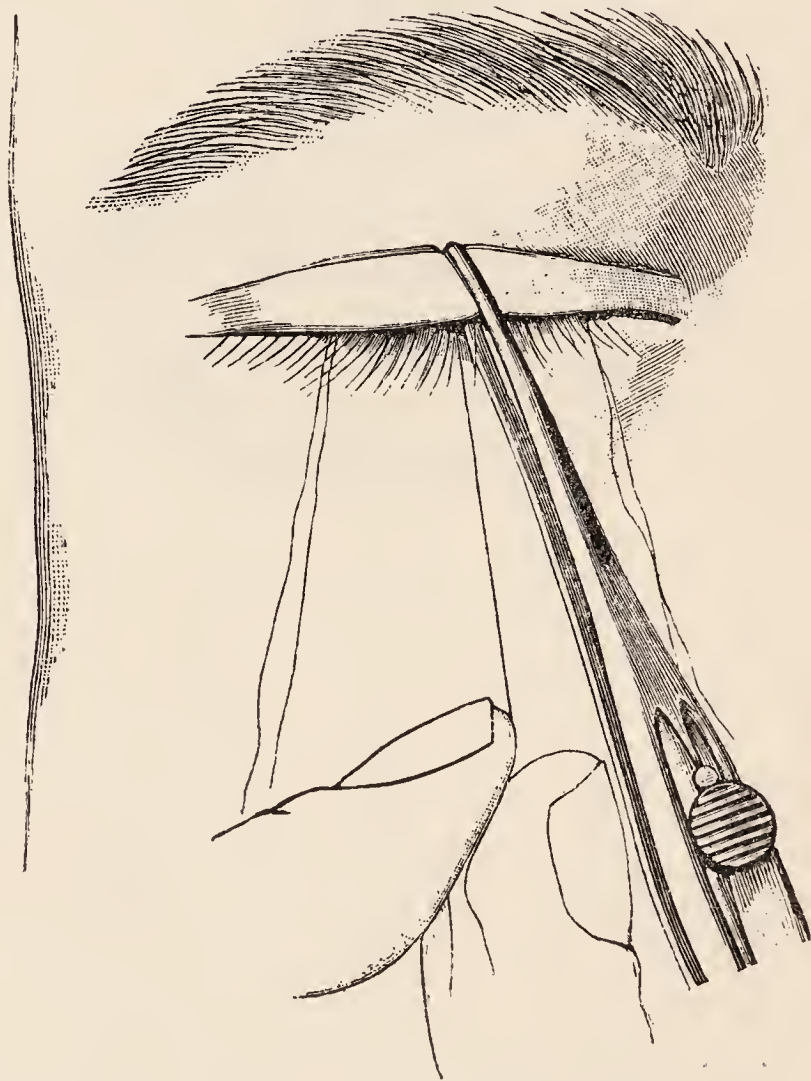


FIG. 65.—Combined excision in trachoma. Insertion of sutures (Kuhnt).—draw the central suture downwards, one of those already passed through the bulbar edge of the first incision, and slightly forwards. The 2-pointed limb of the fenestrated artery forceps is slid upwards along the suture as far as the cut-edge of the tarsus, the two limbs, one inside

and one outside the lid, are closed, and the lid is everted by the forceps, the inner limb of which marks the exact spot where the central suture should be passed (fig. 65). As little as possible of the tarsal edge should be taken up. The other sutures are passed in the same way and then all are tied. Fine black silk is used and the ends cut long so as to hang outside the lids.

In this operation it is very important to spare the bulbar conjunctiva. In making the second incision in the direction of the lid margin we may go within 2·5 mm. of it, but towards the globe in the first incision we may only go so far and remove so much conjunctiva (fornix), that on the strongest drawing down of the eyeball there shall be no traction on the bulbar conjunctiva. When the tarsus is diseased but the conjunctiva over it is smooth, as sometimes happens, the conjunctiva should be dissected off the tarsus if possible and preserved, while the latter alone is removed. In case it is too adherent for this, both tarsus and tarsal conjunctiva will have to be removed.

The dressings are kept moist, the patient stays in bed or in one room, and the sutures are carefully removed on the sixth day.

Trichiasis.

Indications :—Temporary relief may be obtained by epilation. The hairs rapidly grow again and the friction on the cornea is renewed. If not many lashes are displaced electrolysis is a permanent though rather painful cure. Röntgen rays will remove the lashes if properly applied, but it is difficult to limit their action and the hairs may grow again. Where the condition is more advanced an operation becomes necessary. If the trichiasis

involves only a portion—up to half—the lid, Spencer Watson's operation is the best. Where the whole lid is involved and there is entropion as well the St. Mark's (Dublin) operation, which will be described under entropion (p. 156), is the most effective.

Instruments :—Epilation forceps (fig. 66), galvanic battery (the 4 or 6-celled bichromate battery is the most generally useful in India) with a fine short needle as electrode and with a make and break key on the handle, horn spatula, scalpel, needles and sutures.



FIG. 66.—Epilation forceps.

Anæsthesia :—Local—generally by subconjunctival injection, as electrolysis is particularly painful.

Methods :—(1) *Epilation*.—With the patient's head supported from behind the surgeon stands in front, and grasping the cilia one by one by the epilation forceps, extracts them, pulling towards himself in the line of the hair roots. Or, as is better if the hairs are very fine and require the use of a loupe, the patient rests the back of his head against the surgeon's chest, or lies on a couch, and the surgeon draws the cilia out in the axis of their roots, in a direction away from himself. The use of a loupe is often necessary, and the forceps should not be compressed too forcibly as this often opens the extreme tips and releases the hair instead of seizing it tighter. The forceps should be wiped clean between the removal of each hair or they will not take hold well. A slow steady pull is less painful and more efficient than a jerk. Patients can be taught to epilate themselves with the aid of a looking-glass.

(2) *Electrolysis* :—The patient should be lying down and the lid steadied by pressure of the index and middle fingers of the left hand. The moistened positive electrode is applied to the patient's temple, and the negative needle is inserted into the lid alongside the eyelash, which should be held by epilation forceps. The current is turned on (five milliamperes is enough) and bubbles of gas escape along the needle. The hair will come away when drawn upon by the forceps as soon as the destruction is complete, usually in a few seconds. The next hair is then attacked and so on. Considerable reaction follows the operation, and it is some days before the swelling subsides ; a strong (20 p. c.) cocaine ointment may be applied to relieve the pain after operation. The hairs operated upon do not grow again and no scar results.

(3) *Spencer Watson's operation* :—Two incisions are



FIG. 67.—Spencer Watson's operation for trichiasis ; *a b* flaps as cut ; *a' b'* flaps interchanged (Fuchs).

made immediately above and below the cilia of the affected half of the lid and joined at their outer or inner ends according as the outer or inner half of the lid is affected. The depth is enough to include the hair bulbs, and the flap thus fashioned is

dissected up as a tongue of cilia-bearing skin, with its base about the centre of the lid. A horn spatula is placed under the lid while the incisions are being made. From the base of the upper incision a second cut is made towards the canthus, thus fashioning a second flap higher up the lid, not bearing any lashes and with its base at the canthus (fig. 67 *a b*). The two flaps are made to change place and are sewn into place. In this way the transplanted eye-

lashes are removed well away from the cornea and grow in a more natural direction. The skin flap brought down gradually assumes a mucoid character though the small hairs in it remain. They are less irritating than the lashes and the cornea tolerates them better.

Entropion.

Indications :—Spastic entropion affecting the lower lid in old persons, and after cataract operations, may generally be relieved by temporary measures such as collodion, plaster, etc., to draw the lid margin away from the globe, but these failing operation becomes necessary, and excision of an oval strip of skin or the application of Gaillard's suture is required. If there is blepharophimosis canthoplasty (*q. v.*) will be necessary. If due to organic changes in the lid such as are met with in the course of trachoma, the operation chosen depends upon the amount of alteration in the tarsus present. If this is not excessive, the ancient operation of Paulus Ægineta with the modern addition of grafting of mucosa is effective. If the tarsus is much bent, Snellen's operation is better.

Instruments :—Graefe's entropion forceps right and left (figs. 68 & 69), fixation forceps, Graefe's or other fine

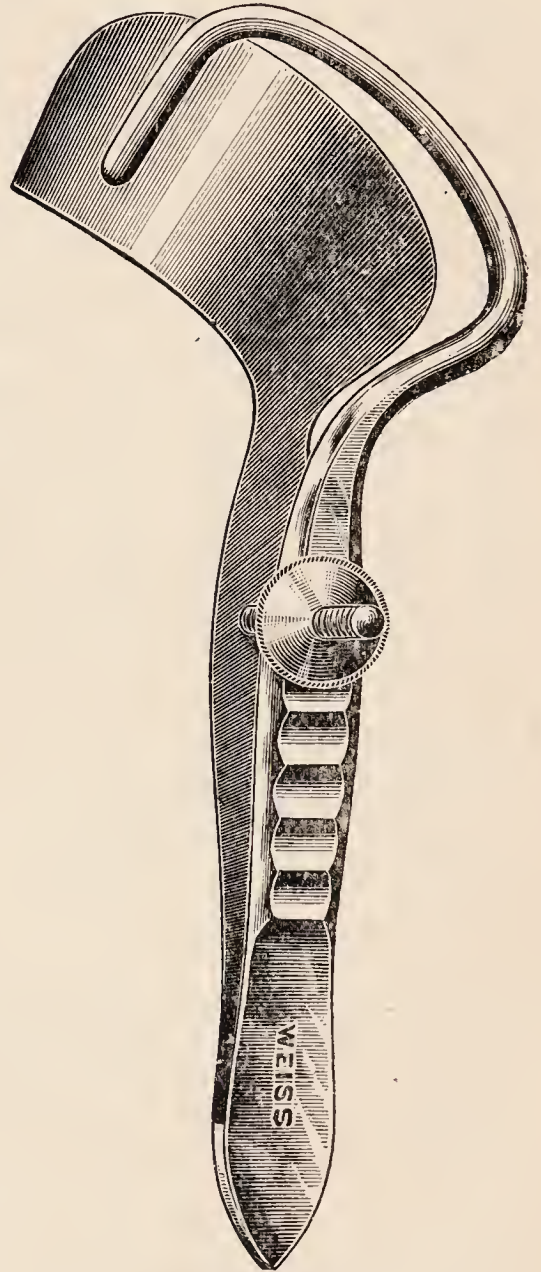


FIG. 68.—Graefe's entropion forceps left eye.

knife, curved scissors, dissecting forceps, six fine suture needles, silk sutures.

Anæsthesia :—Hypodermic injection of eucaine (m. xx. of a 2 p. c. solution) suffices for excision of skin or application of Gaillard's suture. The other operations under discussion require a general anæsthetic.

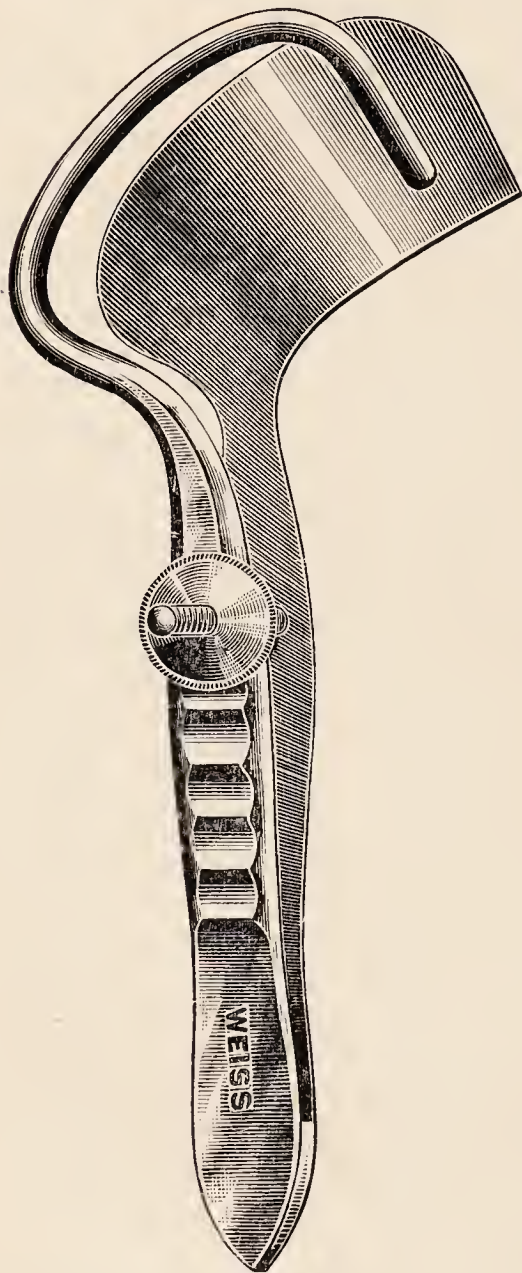
Methods :—(1) *Excision of skin*.—By pinching up the skin over the lid between the thumb and finger near its centre an estimate can be formed of the amount of skin it will be necessary to remove to correct the entropion. The skin is then seized near an end of the lid by means of the fixation forceps and a strip of the width chosen is cut off with the curved scissors. The area removed should reach nearly up to the lid margin, enough skin being left to take the sutures, and at either end it should not reach quite as far as the canthi. Bleeding is free but stops as soon as the sutures, three usually, are tied. It is often recommended that the orbicularis fibres should be removed as well as the skin but this is not usually necessary. If the entropion is not thoroughly corrected and the lashes turned well out on putting in the central suture, it should be removed and more skin cut away. The wound may be painted with collodion over a little absorbent wool, or an ordinary pad and bandage applied. Union is generally complete in two days and the stitches may be removed on the third day.

(2) *Gaillard's suture*.—Two sutures are usually enough and should be threaded with a needle at each end. The two needles of one are then entered through the skin of the (lower) lid close to the lid margin at the junction of the middle and inner thirds about a quarter of an inch or less apart, and are passed downwards deeply beneath the skin towards the angle of the mouth (fig. 76, p. 167). They

should emerge on the cheek one inch below their entry. The second suture is passed parallel to the first and at the junction of the middle and outer thirds of the lid. Both are then drawn tight, and tied over a bit of drainage tube or a roll of gauze, the skin puckering up and the entropion disappearing as this is done. The sutures remain in for three or four days and are then removed when cicatricial bands have formed along them.

A collodion dressing is enough and no after-treatment is required.

(3). *The ancient operation combined with grafting* (often called the St. Marks, Dublin, operation from the hospital where it has been much practised).—The operation includes splitting of the lid, displacement upwards of the cilia-bearing border, grafting of mucosa from the mouth into the wound made by the splitting, and if necessary, excision of an oval piece of skin from the upper lid and suture of the wound thus made.



FULL SIZE

FIG. 69.—Graefe's entropion forceps—right eye.

Graefe's clamp having been firmly applied to the lid so as to stop bleeding and render its manipulation easy, an incision is made with Graefe's knife in the intermarginal space nearly half an inch deep. This incision

should extend from end to end of the lid, as far as the clamp allows, be parallel to the plane of the palpebral conjunctiva, and should divide the lid into two layers, the anterior consisting of skin, orbicularis muscle and cilia, the posterior consisting of the tarsal plate and palpebral conjunctiva (fig. 70). No hair bulbs should be visible on the cut surface, and if any are to be seen on the surface of the posterior flap they should be picked out with the point of the knife. A second lid clamp having been

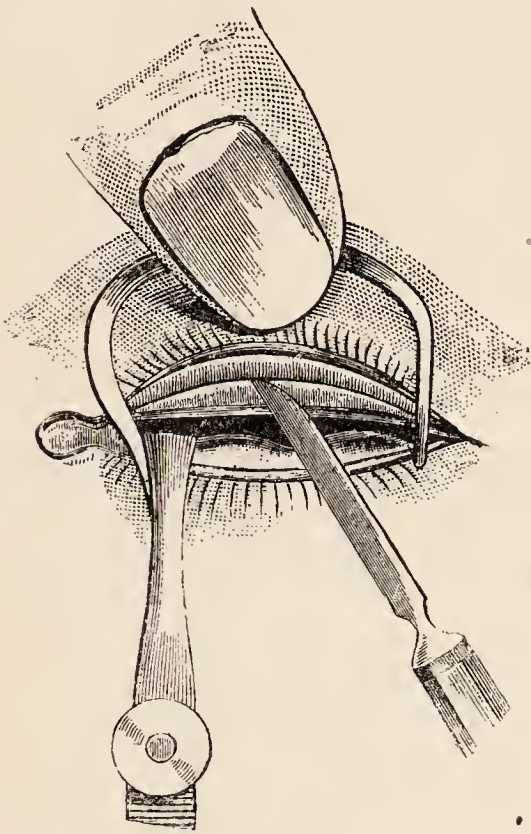


FIG. 70.—Entropion lid splitting operation (Swanzy).

placed upon the lower lid, its open arm on the mucous surface, two parallel incisions are made through the mucosa with the Graefe's knife, about an eighth of an inch apart and not quite as long as the split in the lid. The incisions are joined at either end pointedly, and the diamond-ended oblong flap, thus fashioned out, is dissected up by seizing one point with dissecting or fixation forceps and cutting it off the submucous tissue free from fat by means of scissors. It is then spread out on the left

index finger, and if any fat has been taken with it this can be removed. A silk suture with a knot tied in it a couple of inches from its end, is passed through the graft at one extremity, from the mucous to the raw surface, until the knot catches. The needle is then passed through the lid at one end of the split from within the wound outwards, and that end of the graft tied into

position. The opposite end is next similarly tied into place, and then several sutures are inserted along both edges until the flap is firmly fixed in position from end to end. There need be no fear of putting in too many stitches, and there is no need to allow for shrinking in cutting the mucous graft as it does not shrink, and it fits all the better if it is a little on the stretch. The gap in the lower lid is quickly sewn up with a continuous silk suture. Until now there has been no bleeding. The two clamps are removed and at once there is free bleeding which, however, soon stops and only appears to do good. If there is still a tendency to entropion, an oval piece of skin may now be removed from the upper lid, the extent of which is ascertained by pinching it up first and noting the effect of pinching up more or less skin upon the entropion.

Accidents :—The lid may be perforated in splitting it. It should not occur if due care be taken to keep the knife parallel to the posterior surface of the lid. The cutting across of hair bulbs and its rectification have been mentioned.

After-treatment :—No dressing that can become dry should be applied. The best is sterilised boric ointment spread on lint, and if the patient can be relied on to keep the lids shut no bandage is necessary. Usually both eyes require bandaging for a few days, when the grafts will be found healed. They swell up the first day and look œdematous and as if they would not survive. Their not surviving is quite exceptional.

(4) *Snellen's entropion operation*.—Graefe's lid clamp is applied. An incision is made on the skin surface from one end of the lid to the other, parallel to its margin and about a quarter of an inch distant from it. It extends

through the skin and down to the orbicularis muscle. A piece of this the shape of the wound and nearly as broad is removed, exposing the tarsal plate beneath. A wedge-shaped piece with its apex towards the eyeball is then cut by the knife from the tarsus along its whole length, care being taken to avoid cutting through the palpebral conjunctiva into the conjunctival sac (fig. 71). A silk suture, carrying a needle on each end, having been prepared, one needle is passed from within outwards through the band of muscle and integument left at the

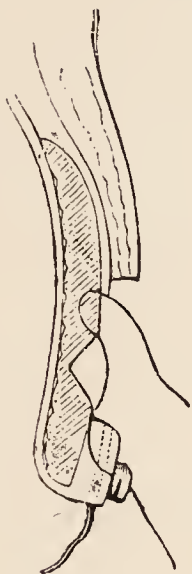


FIG. 71.—Snellen's entropion operation (Swanzy).

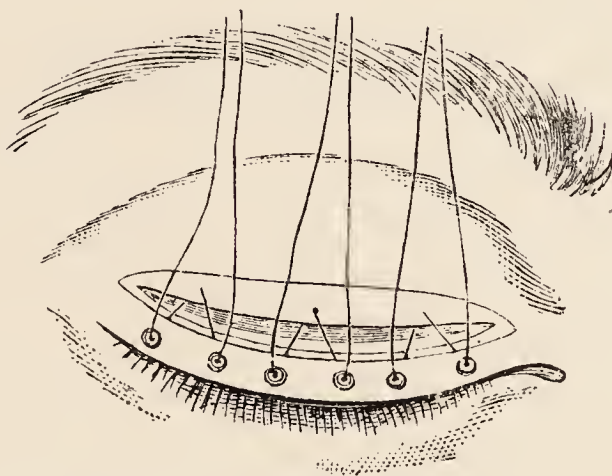


FIG. 72.—Snellen's entropion operation (Swanzy).

margin of the lid. The second needle is also passed from within outwards through the upper lip of the tarsal loss of substance, and then from within outwards through this same marginal band, at a distance of about 4 mm. from the point of exit of the first needle (fig. 72). The ends of the suture are now tied together, a small bead having first been strung on each to prevent it from cutting through the skin (Swanzy). Three such sutures are employed. The eversion produced is more marked if the sutures are brought out behind the lashes at the posterior

margin of the free edge of the lid (Herbert). A collodion dressing suffices and the stitches may be removed after three days.

Ectropion.

Indications :—Cases of spastic ectropion are corrected by Snellen's suture which has the opposite effect of Gaillard's suture in entropion. If the disease be of old standing, Kuhnt's operation or a modification of it is very good. If the ectropion is of paralytic origin tarsorrhaphy (*q. v.*) is useful or Kuhnt's operation may be performed. In cicatricial entropion following burns, etc., the operation must be adapted to each case, the scar being thoroughly removed and Thiersch's skin grafting being performed.

Instruments :—Graefe's lid clamp, scissors, scalpel, dissecting forceps, suture needles, silk threads.

Anæsthesia :—Subcutaneous injection of 2 p. c. eucaïne solution.

Methods :—(1) *Snellen's suture* :—A silk suture is threaded with a needle at either end. These needles are passed into the conjunctival surface of the lid near its margin and at its centre, *i.e.*, at the most prominent part of the conjunctiva, about an eighth of an inch apart, and after a parallel course they are made to emerge on the cheek nearly an inch lower down. A similar suture is passed on either side of the first, half-way towards the two canthi. The ends of all these are tied one after the other over rolls of drainage tube. As they are tied the ectropion disappears. They are left in three or four days under a collodion dressing and then removed.

(2) *Kuhnt's operation* :—This relies on a shortening of the lid to render eversion of the lid impossible. If a triangular piece of the whole lid (with its base at the

edge) be removed, non-union of the edges from traction by the divided orbicularis is likely to occur. To avoid this Kuhnt splits the lid into an anterior layer composed of skin and orbicularis, and a posterior layer of tarsus and conjunctiva. From this posterior layer a triangular portion is then excised. The lid clamp is applied inverted, *i.e.*, with the open blade on the conjunctival surface. The lid is then split by the knife along its edge, posterior to the cilia and anterior to the tarsus. The knife should make the division over a triangle, the area of which has been previously decided upon by the amount of shortening required. The triangular piece is removed by means of scissors. The sides of the triangle are then brought together with silk sutures, the skin edge being very firmly sutured. The skin puckers but this subsides later. This puckering may be avoided by Dimmer's modification of the operation in which the splitting is carried right up to the temporal end of the lid, and then a triangle is excised from the posterior layer at the centre of the lid (as in Kuhnt's operation), and a triangle of skin from the outer end of the lid. The flaps are then slid upon one another and sutured, and no puckering occurs.

Blepharoplasty—Thiersch's Grafting.

Indications :—For scars after caries of the orbit or after burns and other injuries, causing eversion of the lids.

Instruments :—Scalpel, plano-concave razor, probe, dissecting forceps, curved suture needles, fine silk.

Anæsthesia :—Subcutaneous injection of eucaine and adrenaline may suffice, but usually general anæsthesia is required.

Method :—The whole of the scar tissue must first be dissected away. The area should of course have been

sterilised. This excision is required (1) to provide a vascular bed on which the graft will take ; (2) to render the parts movable and to make it possible to restore them to their proper position ; (3) to make a larger raw area than is eventually required in order to allow for the shrinking of the graft which takes place. This excision of cicatricial tissue is the first essential. The next is to free the lid thoroughly until it can be placed in its proper position with ease. To ensure this it is necessary to loosen it until it can be drawn well across in front of the other lid—up or down as the case may be, and there it should be stitched until the graft has taken. A third essential is to preserve the lid margin at all costs.

Having removed the scar tissue the raw area has to be covered and this is best done by Thiersch's method of skin grafting. Pedunculated flaps, *i.e.*, flaps dissected up from forehead or cheek or temple, turned on their bases and sewn into position, have been much recommended, but they are unsightly inasmuch as their bases are puckered, and they increase the actual area of scar disfigurement—nearly double it in fact. Moreover, Thiersch's grafting is so good that nothing better is wanted. The following directions should be observed. Sterilise the skin where the graft is to be taken, usually the inside of the upper arm, carefully twenty-four hours before, and again just before operation. Make an assistant assist you to draw the skin on the arm very tight, and moisten skin and razor with sterile saline solution. Take up as large a graft as possible up to one-third larger than the raw area to be covered. Cut with the razor's edge towards oneself and with a series of rapid short to and from movements, not stopping if possible until the length of graft cut is that desired ; no fat should be taken up,

only epidermis and the superficial layers of the cutis. To cut out finally turn the edge away from the arm pressing the graft on the razor with the finger and with a short side cut the separation is completed. If the razor edge be turned forward without this precaution, the graft will merely push along in front of the edge and slip off the razor on to the arm and have to be taken up again with much trouble. See that the raw area to be grafted has stopped bleeding. It usually has by this stage. Place the razor on the raw area, the graft resting on it, and with the probe draw the graft off its edge, gradually withdrawing the razor from under it as this is done. A little saline solution helps this transference. If the whole raw area is not covered more grafts must be cut until it is. Should the scar tissue be so extensive that all cannot be removed the old plan in use for chronic indurated ulcers, of making radiating incisions into the edges may be adopted. This relieves tension and provides areas that may be grafted with advantage.

After-treatment :—The raw area on the arm may be covered with sterile gauze and bandaged, and on opening it a week or ten days later it will be found healed. In a quiet patient the graft may be left without any dressing. The author has kept all skin grafts exposed to the air without dressing as far as possible—using wire gauze cages or mosquito netting to keep off insects—for some time now, and has found them do better than when dressed.* In children and unruly patients a dressing will be needed, and in some it may be advisable to stitch the grafts in position. An ideal dressing would be one that could

* Journal of the Asiatic Society of Bengal (Medical Section), March 1907; *Indian Medical Gazette*, Jan. 1908.

be changed without dragging upon the grafts. Gutta-percha tissue may be used next to them, but it is difficult to sterilise, and it is hot and steamy. Sterilised vaseline on lint forms a good dressing and may be covered with gauze and bandaged. Both eyes had better be bandaged. Care must be taken not to drag the grafts in bandaging. The grafts swell up and the outer epithelium softens and comes away. Provided asepsis be observed, and no movement permitted, union is the rule. If dressed, the dressings need not be changed until the fourth or sixth day.

Chalazion.

Instruments :—Graefe's knife, small Volkmann's spoon, chalazion forceps may be used (fig. 73).

Anæsthetic :—Local. The operation is painful whatever local anæsthetic is used unless it is injected. The use of chalazion forceps seems to lessen the pain.

Method :—The lid is everted and the point of the knife made to puncture the centre of the chalazion from the inner surface of the lid. It can be recognized by its being of a deeper red colour and more spongy-looking than the rest of the conjunctiva. The knife is made to enlarge the opening in the direction of the Meibomian



FIG. 73.—Chalazion forceps.

glands, *i.e.*, at right angle to the lid margin (fig. 74). The spoon is then introduced and the granuloma scraped out. Bleeding is free and the cavity remains filled with blood for some days after. A simple boracic pad and bandage may be applied for twenty-four hours.

Meibomian Infarcts.

After instillation of cocaine the lid is inverted, each yellow point is punctured with a Graefe's knife, and the infarct scraped away with the small Volkmann's spoon.



FIG. 74.—Chalazion operation. The incision, using forceps.

No dressing is required. The eye may be washed for a few days with boric lotion.

Canthoplasty.

Indications :—In cases of trachoma where the palpebral opening is contracted (blepharophimosis) and the lids press unduly on the globe; where the palpebral opening is of small size as a result of long continued blepharitis or chronic conjunctivitis; in cases of congenital defect. It is temporarily performed, *i.e.*, without

suturing, in gonorrhœal ophthalmia to facilitate treatment and abolish blepharospasm, and in removal of ocular and orbital tumours to allow free access.

Instruments :—Speculum, strong scissors, dissecting forceps, Spencer Wells forceps, suture needles, silk sutures.

Anæsthesia :—Local suffices—by injection if the patient be hypersensitive.

Method :—A speculum is not necessary but it is useful. The lids are drawn well towards the nose and

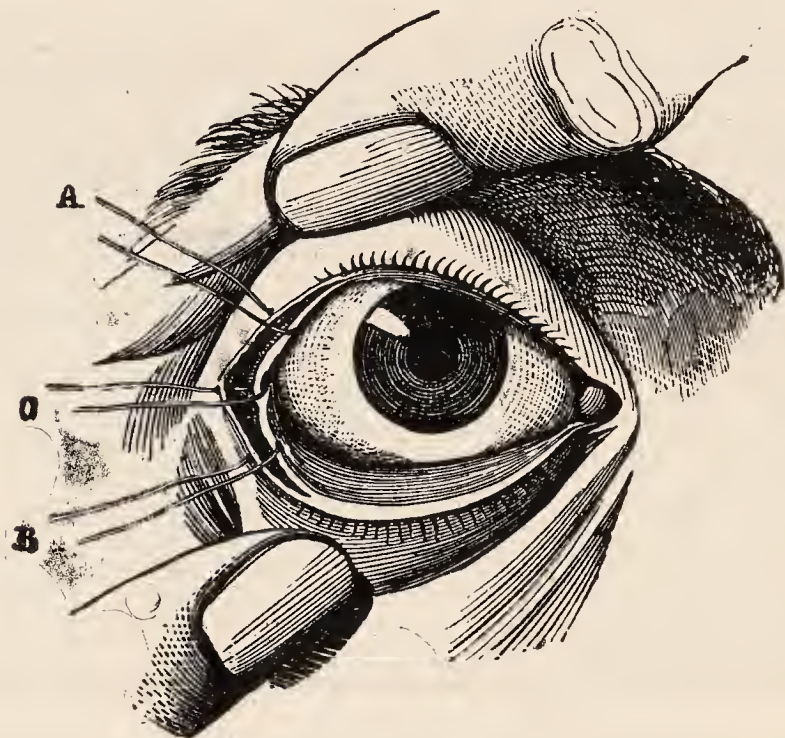


FIG. 75.—Canthoplasty (Swanzy).

held well apart by the fingers or the speculum. The scissors are then used to cut through the outer canthus, in the line of the palpebral fissure, one blade being pushed well into the corner of the conjunctival sac, the other laid on the skin surface. Bleeding is free and a vessel usually spouts. It may be compressed by the artery forceps until the sutures are inserted. The conjunctival edge is then sutured to the skin edge, the first stitch being inserted at the centre of the wound (fig. 75).

After-treatment :—Pad and bandage for three or four days and then removal of the stitches.

Tarsorrhaphy.

Indications :—In ectropion, senile or paralytic, and in slight cases of cicatricial ; in lagophthalmos, particularly in that form met with in exophthalmic goitre. Provisionally the lids may be united at their centre, without paring of the edges, in cases where there is great tension, as, *e.g.*, when tarsorrhaphy is to be performed in the usual

way in exophthalmus, or when optico-ciliary neurectomy is followed, as it may be, by proptosis from retro-bulbar hæmorrhage.

Instruments :—Dissecting forceps, fine scalpel, suture needles, silk sutures.

Method :—Median tarsorrhaphy (at the inner canthus) is very rarely performed. The lateral as modified by Fuchs is generally done (fig. 76).

In this the ciliary border

of the upper lid together with the cilia, are removed, and the raw surface united with the prepared lower lid margin as follows :—The lower lid is split along its edge as far from the canthus as is desired. At the inner end of this incision a vertical cut is made through the skin. A flap is thus formed of the anterior portion into which

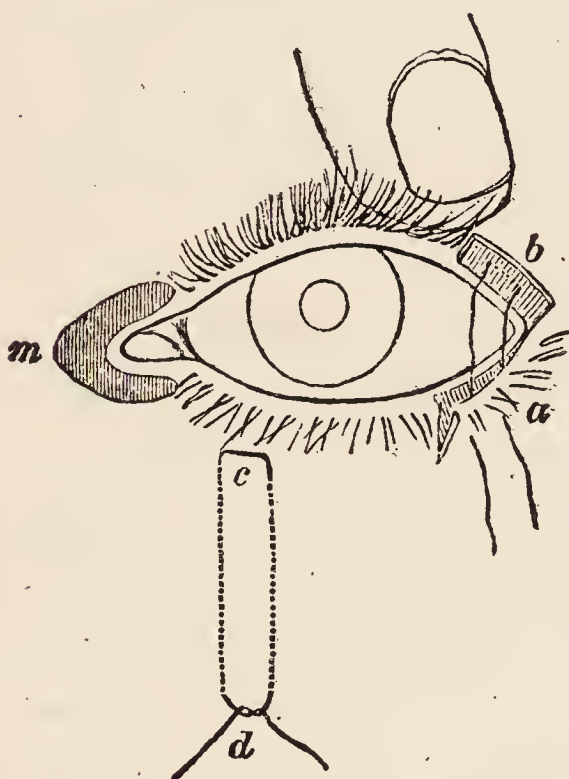


FIG. 76—Tarsorrhaphy—lateral at the outer canthus, median at the inner. Gaillard's suture shown below (Fuchs).

the lid was split. The upper lid is treated similarly, but the ciliary border with cilia is cut away instead of being retained as in the lower lid. The two raw surfaces thus formed are sutured together. A suture has needles threaded at either end. These needles are then introduced through the palpebral conjunctiva of the upper lid, *i.e.*, from within outwards, emerging on the raw surface. They are then passed through the lower lid from the raw to the skin surface, emerging upon the lower lid and are tied over beads on the skin. This draws the two raw surfaces into accurate opposition and secures firm union.

After-treatment :—A sterile pad and bandage are applied for five or six days and then the sutures removed.

Epicanthus.

If moderate degrees of this were regarded as pathological every member of the Mongolian races would require operation. In Caucasian races it is common in children in slight degree, but as the nose bridge grows it disappears. If it does not, it may be removed by the operation devised by Ammon, in which an elliptical piece of skin is excised from the bridge of the nose, its long axis being vertical. The amount required to be removed to cure the deformity can be estimated by pinching up the skin first into a vertical fold. The incision should be brought together by sutures and the wound sealed with collodion until healed. A hypodermic injection of eucaine renders the skin operation painless.

Ptosis.

Indication :—The multitude of operations devised for the cure of ptosis shows the unsatisfactory results achieved. Haab describes thirteen of them and more have

been invented since he wrote. In slight degrees limited to one eye the use of an eyeglass, especially one on a projecting frame, will suffice to raise the lid. When an operation is required, the choice will depend upon the nature of the ptosis. If the levator palpebræ superioris is paralysed, or not developed, as it is in cases of paralytic and congenital cases, the operation must depend upon the frontalis muscle being made use of. If the levator retains some power it may be either shortened or advanced. Only two operations to be performed under these two conditions will be described. Excision of skin and orbicularis (von Graefe) is not recommended or described because if extensive enough to shorten the lid as much as is required lagophthalmos results.

To ascertain if the levator muscle is functionally active, the eyes should be closed and the frontalis should be prevented from acting by pressing on the forehead with the hand. When the patient is made to look up the action of the levator will be observable if present.

Instruments :—Dissecting forceps, scalpel, scissors, six half-curved suture needles, silk, small rubber drainage tube.

Anæsthesia :—General is necessary.

Methods.

(1) *Hess's operation* :—For ptosis in which the levator is ineffective and the frontalis has to be made use of. The eyebrow should be shaved, and it and the skin of the lid well sterilised. An incision is then made along the centre of the eyebrow in its whole length, through the skin and subcutaneous tissue (fig. 77 *a a*). Starting in the depth of this wound the scalpel is used to gradually separate the

skin of the lid from the underlying orbicularis muscle, working downwards and keeping the separation carried up to either end of the wound all the way down nearly as far as the ciliary margin. In this way a large pocket as it were is formed, of which the anterior layer is skin only and



FIG. 77.—Hess's ptosis operation *a a* eyebrow incision, *b b* sutures (Swanzy).

the posterior is the rest of the lid (fig. 77). Three sutures, each about six inches long, are threaded with a needle at either end. The needles are then passed through the anterior layer of the pocket from the skin surface inwards, entering along a line situated a third of

an inch above the lid margin where the natural crease in the lid is found when the eye is open (fig. 77 *b* and fig. 78 *A*). The two needles belonging to each suture should be entered an eighth of an inch apart, and the three looped sutures should be placed one at the centre of the lid and the others one on either side at nearly half an inch distance. The needles emerge within the open pocket, and after traversing that, are then made to perforate the structures in the upper lip of the wound through the eyebrow, emerging on the skin of the forehead nearly half an inch above the eyebrow area. The three loops thus inserted are drawn tight and tied over a roll of drainage tube. On tightening them the fold produced in the upper lid—which as already stated corresponds

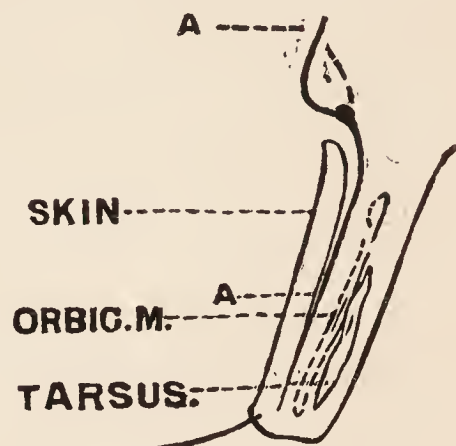


FIG. 78.—Hess's ptosis operation. The needles enter at lower *A* and emerge above eyebrow at upper *A*. (Swanzy).

with the natural fold—is drawn upwards and the ptosis is removed (fig. 79 *a a'*). The wound in the eyebrow is sewn up by a continuous suture, and is invisible when the eyebrow has grown again. The sutures are left in eight or ten days and tightened up if necessary, for which purpose the knots may be bow knots instead of ordinary reef knots. The cicatrization which is manifestly of considerable extent, fixes the fold in the position required to remove the ptosis and also unites with the lower fibres of the frontalis muscle, thus enabling this muscle to in part replace the levator. An aseptic dressing is applied and both eyes are bandaged.



FIG. 79.—Hess's ptosis operation, after tightening of the sutures (Swanzy).

(2) *Snellen's operation*.—For cases of ptosis in which the levator muscle is still capable of some action. In this operation a portion of the levator muscle is excised. An incision is made parallel to the lid margin, and in the line of the natural fold, a third of an inch above the lashes. This is carried through the skin and orbicularis muscle, and by drawing the fibres

of this up and down the levator tendon is exposed. The tarso-orbital fascia is incised at either side and the tendon clearly defined. Four sutures are introduced through the upper part of the muscle from before backwards, passed along its deep surface and out again, nearer together, through the tendon from behind forwards below, *i.e.*, near its insertion. A strip of the muscle is then excised within the sutures, and on tightening them the resected muscle is reunited in a shortened condition. The skin wound is sewn up and an aseptic dressing applied, both eyes being bandaged for some days.

Elephantiasis.

Great hypertrophy of the lids is sometimes met with and not always in connection with elephantiasis elsewhere. The upper lid is chiefly affected. No set operation can be performed for these cases. But excision of the mass, preserving the lid margin and tarsal plate as far as possible, must be done. Division of the external canthus with removal of part of the elongated lid and subsequent tarsorrhaphy, are usually required. The results are not very satisfactory and some degree of ptosis often remains.

CHAPTER XI.

OPERATIONS ON THE LACRYMAL APPARATUS.

SYRINGING SAC—SLITTING CANALICULUS—PROBING— EXTIRPATION OF SAC.

Indications :—If a case of lacrymal obstruction is seen before it has received any treatment, it is best to attempt it scure by simple syringing every day, not neglecting the treatment of the nose usually required. Cocaine is necessary, and if adrenaline also be instilled, the solution is more likely to pass. The lower canaliculus may require dilating with a conical probe or dividing before the introduction of the syringe nozzle. Failing success probing may be tried with Weber's or Theobald's probes, the lower canaliculus being first slit up. Should these fail, as not infrequently happens, a time comes when the patient suffers from "epiphora and pus alternating with probes and pain" as Parsons graphically puts it, and extirpation of the lacrymal sac is advisable. Incision of the nasal duct stricture and the use of styles are not to be recommended.

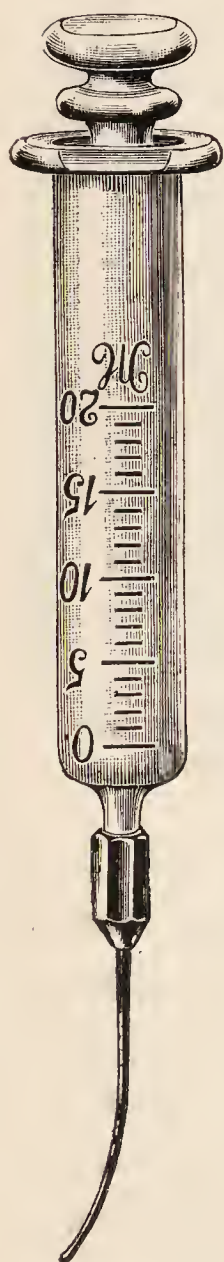


FIG. 80.—Luer's lacrymal syringe.

Syringing the sac.

Instruments :—Glass syringe (better with lateral rings) and silver or platino-iridium blunt

ended small sized nozzle (fig. 80). Nettleship's conical probe (fig. 81), or Galezowski's dilator (fig. 82).

Anæsthesia :—Local. If adrenaline is instilled also it tends to make the canal more patent.



FIG. 81.—Nettleship's conical probe.

Methods :—The patient should be either recumbent or leaning back against the operator. In either case the latter looks down upon the patient's eye and holds the filled syringe, all air being carefully expelled from it, in the hand corresponding to the eye to be treated. Passing the opposite hand across the patient's face, the thumb is applied at the centre of the lower lid, and the lid is drawn strongly outwards and slightly downwards (fig. 83). The effect of this is to

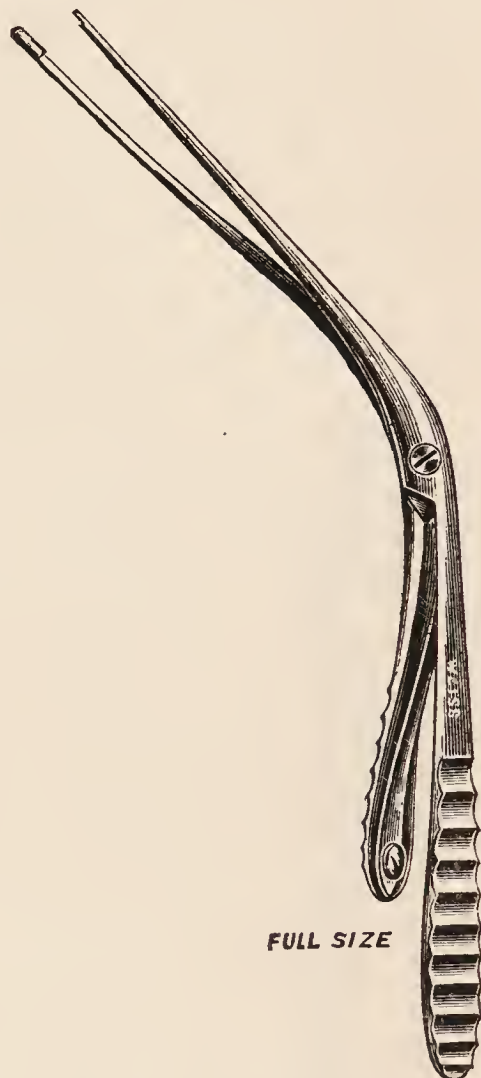


FIG. 82.—Galezowski's caniculus dilator.

evert the punctum and render it visible and to stretch the canaliculus and straighten the passage. The patient's head is steadied by the forearm of this hand or by an assistant. The needle of the syringe is passed in through the punctum, which has been dilated if necessary or enlarged by incision, and passed steadily on into and across the lacrymal sac until it comes in contact with the inner wall of the latter. The patient is generally conscious when this

is reached if the surgeon is not, and the motion should be stopped at once and the needle withdrawn about an eighth of an inch, so that the end lies free in the sac and not in contact with its wall. Holding the syringe firmly the solution is slowly injected. If the duct is pervious the patient will feel the solution trickling into the nose, and on his blowing it into a handkerchief or on to a vulcanite tray one can see the nature of what has passed through. If not pervious the sac will become distended with the solution, and more or less will regurgitate alongside the needle



FIG. 83.—Syringing the lacrymal sac.

or through the upper canaliculus. Sometimes the fluid passes through into the nose some hours later and sometimes it will not begin to pass until syringing has been done for several days or until a probe has been passed.

If the nozzle cannot be introduced as directed, it may be necessary to enter it vertically to the surface of the lid through the punctum and then bring it down to the horizontal position as it passes on through the canaliculus. Should the punctum be too small, it must be dilated with

Nettleship's probe or Galezowski's dilator. One should not attempt to pass the nozzle on through the sac into the nasal duct. There is no object in doing so and damage may be inflicted in the attempt.

Accidents :—Injury of the inner wall of the sac is avoided by the precautions given. Injury not only may lead to infection and an acute dacryocystitis, but to the injection into the tissues of the fluid used. In the case of argyrol, protargol, etc., this will cause a permanent discolouration. A false passage leads to the same disasters if not recognized.



FIG. 84.—Weber's canaliculus knife.

Slitting the Canaliculus.

Instruments :—Conical probe, Weber's probe-pointed canaliculus knife (fig. 84).

Anæsthesia :—Local.

Method :—Position and hands as in syringing. The knife is introduced exactly in the same way as the nozzle of the syringe, but its edge must look upwards and backwards—speaking as if the patient were in the upright position—towards the eyeball. As it passes along the canaliculus, its edge divides that canal, opening it through its conjunctival aspect and into the conjunctival sac, not towards the skin. This drains the tears from the sac better and is not disfiguring. Dividing the outer half of the length of the canaliculus is enough to allow probing or syringing to be carried out; a division of its inner half into the sac is very rarely necessary, and should not be done if it can be avoided as the functions of the sac are thereby interfered with. Regurgitation occurs and the restoration of the sac's power of retraction is rendered less likely.

Accidents :—None should occur if the surgeon is careful and the patient's head is kept still. The probe point of the knife makes a false passage almost impossible.

Probing.

Instruments :—Theobald's probes—using the smaller sizes only—are good, being slightly conical the first half inch and then of even thickness, having a slight curve throughout and a flat flange at the centre to take hold by and to indicate the direction of the point. Couper's are slightly olivary pointed (fig. 85).

Anæsthesia :—Local. Adrenaline assists by causing ischæmia of the mucous membrane lining the nasal duct and so enlarging the passage slightly.

Method :—Position and hands as for syringing. The probe is introduced exactly like the syringe nozzle, the lid being drawn outwards, and the lower canaliculus having been dilated or divided if necessary. If the patient be sitting in a chair with the head supported, the surgeon may stand in front and then the hands used are the reverse of those described above. It is safer, however, to have the patient either lying down or leaning back against one, as it is all-important to

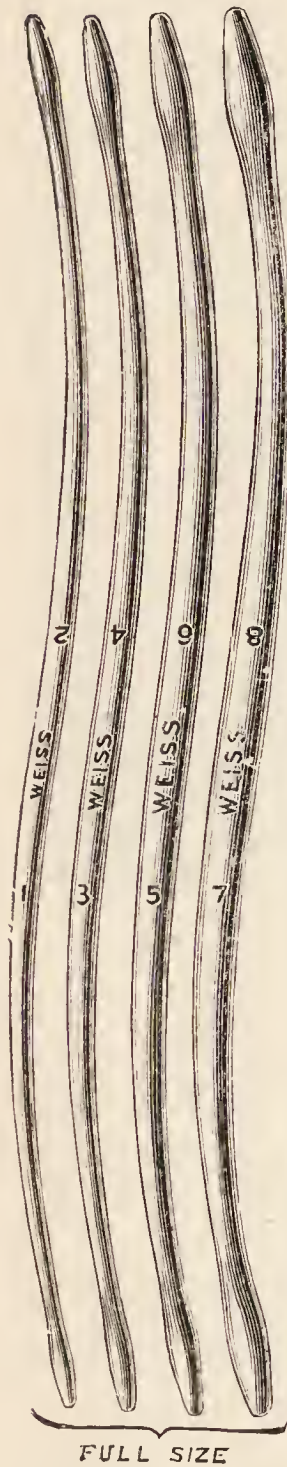


FIG. 85.—Couper's lacrymal probes.

have the head fixed securely when the pain is felt, as it nearly always is in spite of anæsthetics.

On the probe point reaching the inner wall of the sac the outer end is raised upwards along the eyebrow so as to bring it into a position almost parallel to the nose with its lower end now pointing downwards, outwards and a little backwards, towards the furrow between the nose and cheek. While it is being so raised gentle pressure should be kept up so that the point glides along the inner wall of the sac and enters the upper end of the nasal duct (fig. 86). It is then pushed



FIG. 86.—“ Ghost ” photograph, showing movements of hand in passing lacrymal probe.

slowly and steadily onwards down this until the right length (rather more than three-quarters of an inch) has passed and the end is felt to rest on the floor of the nose. It is usually left in a quarter of an hour and then withdrawn. If syringing is required as well, it should be done before and not after probing, in case any abrasion has been caused and the solution find its way into the tissues.

Accidents :—False passages are the most frequent and can be avoided only by great care and gentleness in probing. If even the smaller sized probes cannot be

passed, no prolonged attempts should be made at one sitting to get one through. Letting the patient squeeze out the sac twice or thrice daily and instilling antiseptic lotions into the conjunctival sac which then find their way into the lacrymal sac, for a few days, will render a later attempt possibly successful.

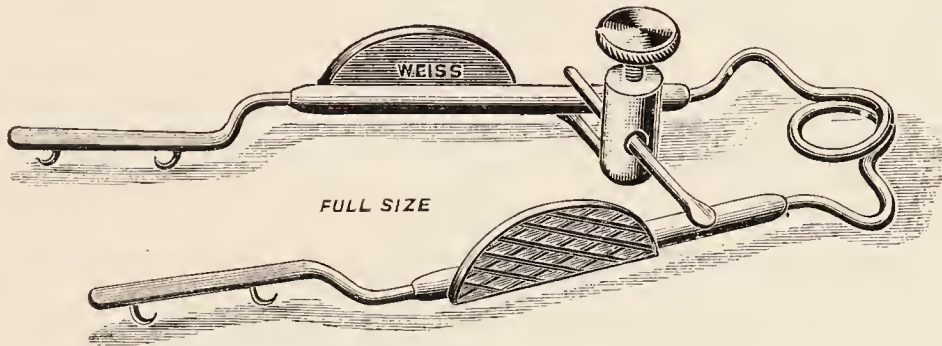


FIG. 87.—Müller's lacrymal speculum.

Extirpation of Lacrymal Sac.

Instruments :—Müller's sharp-hooked speculum (fig. 87), periosteal raspatory, or Farabœuf's rugine,

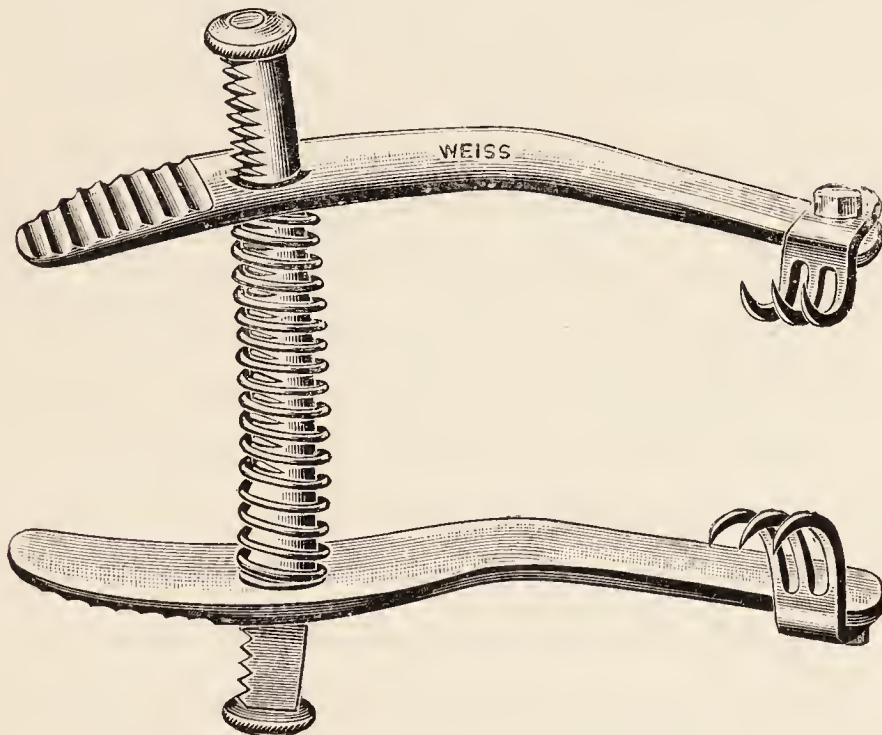


FIG. 88.—Axenfeld's lacrymal retractor.

Axenfeld's retractor (fig. 88), scalpel, blunt-pointed scissors, sharp Volkmann's spoon, fixation forceps, Spencer Wells' forceps, curved suture needles, fine silk-worm gut.

Anæsthesia :—General anæsthesia is the most satisfactory. If it is contra-indicated infiltration with Barker's solution (p. 27) may be used. Twenty minims may be injected hypodermically along the front of the sac twenty minutes before operation. By that time the area of operation will have become blanched and the anæsthesia be fairly complete.

Method :—The skin over the sac, nose and cheek is well cleansed and the sac itself washed out with an antiseptic solution. The surgeon stands at the patient's side—to his right for the right sac and to his left for the left. To define the sac it is sometimes injected with melted hard paraffine. This is difficult to do and unnecessary. The crest of the lacrymal bone, which is an important landmark as marking the inner edge of the sac, is easily felt by drawing the eyelids outwards and so putting on the stretch the internal palpebral ligament which leads up to it. The sac is about half an inch in length in the normal state and lies in the bony groove formed by the lacrymal, and nasal process of the superior maxillary, bones. The tendo-oculi or internal palpebral ligament crosses in front of it above its centre, Horner's muscle and the reflected portion of the same ligament pass behind it. It is flattened laterally and its capsule is firmly adherent to the periosteum of the bones. Between them is the plexus of veins which causes the troublesome bleeding met with in extirpation of the sac. A curved incision an inch or more long is made beginning just above the inner palpebral ligament, passing downwards inside the inner canthus and curving outwards along the orbital margin. This incision is made down to the bone, cuts through the internal palpebral ligament at its insertion and the periosteum is divided by it. If the

incision is made too near the nose the angular vessels may be wounded and give trouble. The sac appears of a deeper red and firmer texture than the surrounding tissues. Müller's speculum is inserted to hold the wound open from side to side. Axenfeld's powerful retractor is then applied with the longer hook downwards, so as to draw the upper and lower borders of the wound forcibly apart, grasping all the soft parts down to the sac within its strong curved hooks (fig. 89). This

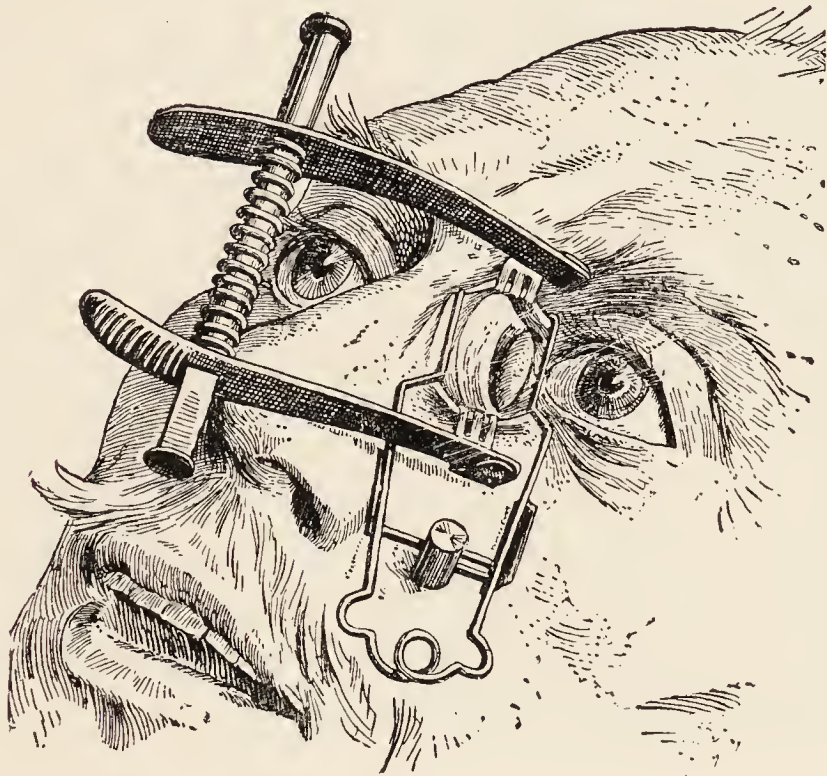


FIG. 89.—Extirpation of the lacrimal sac (Swanzy).

usually stops all the bleeding, and if not stopped enough, firm pressure with a swab soaked in adrenaline solution should be made for a couple of minutes before proceeding. The sac together with the periosteum is now separated thoroughly along its inner aspect from the lacrimal groove with the raspatory (Plate VI). The sac is drawn forwards with fixation forceps and its upper end and posterior surface freed with scissors, the two canaliculi being divided on its outer side. The remains of the internal palpebral ligament

must be cut across, and the sac, now free everywhere but below, is drawn well up and the nasal duct cut across as low down as possible. The nasal duct is scraped with a small spoon and touched with a small swab of pure carbolic acid. Any diseased bone is removed. The two specula are removed. The edges of the wound are then brought together with two or three deeply placed silkworm gut sutures, the first of which must be opposite the internal canthus. They must be deeply passed to keep the internal palpebral ligament in place and prevent possible disfigurement. A firm graduated pad is placed over the wound to keep up pressure and a bandage is applied—to both eyes for one day and to the operated eye for a week. The stitches may be removed any time after the sixth day. The scar is usually invisible. Primary union is the rule in spite of the sac being generally septic. If the operation has been unusually difficult it is well to leave the lower part of the wound unsutured for the serous discharge to escape through.

Accidents :—The treatment of hæmorrhage has been dealt with. If the angular vessels are wounded pressure forceps may be required. If the sac is dissected into early much trouble may be met with in removing it, and in such cases what remains will have to be scraped out. This is more likely to occur in small sacs and those much cicatrised with dense adhesions. Such provide difficult operations, often with much hæmorrhage. On the other hand excision of a large mucocele is a simpler matter. The sac can never be removed entire of course like a cyst, as the three communicating tubes—nasal duct and two canaliculi—must be cut across. If the sharp hooks of Müller's speculum are small and short, as sometimes supplied, the skin may be insufficiently retracted on the

outer side of the wound, and it may be damaged in dissecting out the sac by button-holing. If Müller's speculum is not available or the hooks are too small, the wound may be held open laterally by a Volkmann's three-pronged retractor on the outer side and a pair of Spencer Wells' forceps fixed on to the periosteum on the inner side as in fig. 90, where Axenfeld's

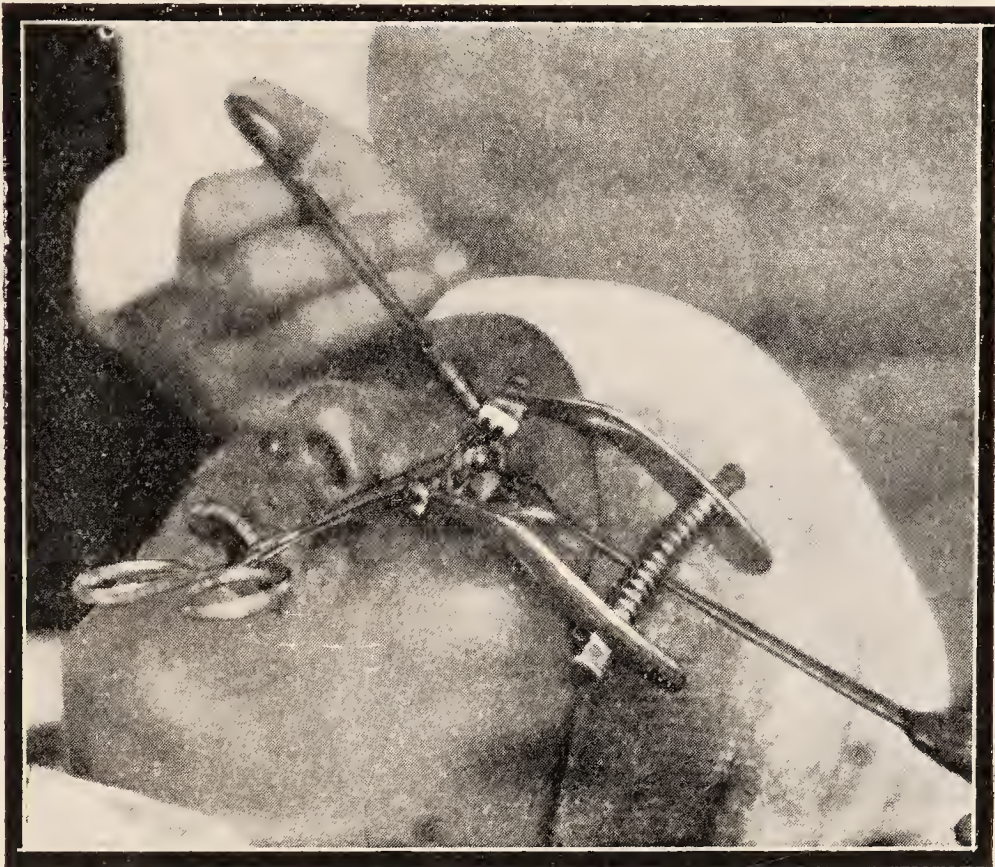


FIG. 90.—Extirpation of the lacrymal sac. Upper Spencer Wells on a vessel, lower holding periosteum inwards. Internal to Volkmann's retractor the sac shows white. Between white sac and forceps is bare bony surface from which the sac and periosteum were raised by a raspatory.

retractor is also used differently to the usual way. Care has to be taken that the cornea is not damaged in any of the manipulations as serious inflammation of it would probably result. Care should be taken in clearing the outer side of the sac as a case has been recorded of injury to the internal rectus muscle during the operation,

with consequent limitation of movement of the globe and diplopia. The orbital tissues may be opened behind the sac, or the bone may be injured by the raspatory if force is used carelessly. Necrosis of the bony parts may be met with and may complicate healing. The diseased bone must be removed as far as possible or scraped if removal is impossible. Suppuration of the wound may happen and then healing is by granulation. Epiphora is rare after a while, though it may, very rarely, necessitate extirpation of the lacrymal gland.

CHAPTER XII.

REMOVAL OF FOREIGN BODIES FROM THE INTERIOR OF THE EYEBALL. (1) FOREIGN BODIES OTHER THAN IRON. (2) IRON FOREIGN BODIES—MAGNET OPERATIONS.

Foreign bodies other than iron.

IN these cases the magnet is no use. They include all foreign bodies consisting of anything but iron and may be situated in any part of the eyeball. Their removal from the anterior chamber is a simple matter. Paracentesis with the introduction of a pair of iris forceps is all that is required. If fixed in the iris an excision of the involved part of that structure may be necessary. This may be also needed if the foreign body is in the posterior chamber. In the lens it causes opacity—traumatic cataract—and the best treatment is to operate upon that in the usual way, the foreign body being removed along with the soft lens matter (see p. 63).

Should the body be in the vitreous its removal is very difficult and enucleation may become necessary. If it can be seen ophthalmoscopically a posterior sclerotomy may enable it to be removed by a pair of iridectomy or capsule forceps, introduced through the incision and guided to it by direct observation through the pupil.

Iron foreign bodies—magnet operations.

Indications:—The particular operation to be performed depends upon how recent the injury is, where the particle

of iron is situated in the eyeball, and lastly, upon what instruments are available for its extraction. The giant magnet which is very heavy, and which requires a good supply of electricity to work it, is seldom available outside ophthalmic hospitals. Snell's smaller magnet is more easily obtained and worked and therefore is more generally useful.

The localisation of the iron is all-important, though in quite recent cases and with the giant magnet available it is better to proceed with the extraction at once than to waste valuable time in taking X-ray photographs, using the sideroscope, etc. Our means of localisation are : (1) deductions drawn from the wounds and the history of the case. The position of the wound, on the cornea or in the sclera, and the direction in which the patient was looking when hit by the foreign body, and the size of that if known, help one in judging where to look for it. Wound of the iris or lens, or tracks of blood in the vitreous, suggest the depth to which it has penetrated; (2) ophthalmoscopic examination. This is of use in old cases, and in recent cases if there has not been much bleeding, it may be easy to exactly localise the iron. The pupil must be well dilated before attempting it. If the lens has been wounded, twenty-four hours, or even less, is long enough to destroy its transparency and so render ophthalmoscopic examination of the fundus impossible; air bubbles in the vitreous render penetration probable but not certain; (3) X-ray photographs. The use of the screen is not enough. Mackenzie Davidson's localisation apparatus should be used and two photographs taken with it. By means of these it is possible to accurately localise the position of the particle and to know its exact size before operating; (4) the sideroscope (Hirschberg's) by means of which a

magnetic needle is deflected on approaching a particle of iron, is useful in revealing the presence or absence of iron. As its situation has to be guessed at from the deflection of the needle being greater when nearer it, the localisation is only approximate; (5) the use of the magnet. On bringing the eye within the influence of the magnet pain may be felt—this is not the case with very small foreign bodies, especially if deeply situated, or bulging may be seen. In some cases the whole eyeball may be seen to be drawn forwards, in others the structure in which the foreign body is imbedded, lens or iris, etc., may be drawn forwards.

If the iron is firmly embedded in cicatricial tissue and the eye perfectly quiet when first seen, some years after the injury, it may be better to leave it alone, as its removal will damage the eyeball and probably set up serious inflammation ending in blindness. The exception to this may be when it is imbedded in the lens. Extraction is then less likely to be followed by evil result. In all recent cases attempts should be made to extract, because, if left, immediate or remote inflammation is probable (we do not know if the particle is septic or not), with danger of sympathetic involvement of the other eye, and, even if immediate inflammation does not occur, the particle becomes encapsuled in inflammatory tissue and its removal is rendered much more difficult by delay.

Instruments :—Snell's magnet which may be worked with a bichromate battery, or Hirschberg's or Haab's or Schloesser's giant magnet, each of which is worked from the main street current. Before using any magnet those present should leave their watches at some distance or they may become magnetised. Watches so magnetised stop at once and may give trouble for a long time, even after being

demagnetised. Snell's magnet is fitted with various sized and shaped needles, which can be unscrewed and sterilised before use, and which may be passed into the interior of the eyeball if necessary. The different points can raise and hold suspended weights varying from 7 ounces to $2\frac{1}{4}$ lbs.; the magnet employed without any end-piece holds $3\frac{1}{2}$ lbs.

The giant magnets are fitted with a conical point to which the patient's eye is gradually approached, or when necessary the eye being near the current is switched on by a foot pedal, a spring on the pedal opening the current when the pressure of the foot is relaxed. Volkmann's magnet is suspended and brought near to the patient who is lying down. The narrowing of the point of the magnet is necessary to afford a clear view of the patient's eye. It lessens the power, but this may be increased by unscrewing the tip a little. The ordinary instruments for iridectomy should be ready as well as the magnet, including a Graefe's knife to make a meridional sclerotomy if need be, and a Lang's spatula or squint hook which can be connected on to the giant magnet and used if required to extract from inside the eye.

Anæsthesia :—Local, combined with the use of atropine and adrenaline. General anæsthesia is only necessary in children and is to be avoided if possible, as the assistance of the patient in moving the head and eye, and in indicating the seat of pain, is desirable.

Methods : (1) *with the hand magnet* :—The advantages of the hand magnet are its light weight and consequent portability and easy manipulation, its easy working by means of a bichromate battery, its cheapness, and the possibility of introducing its point into the globe when the foreign body is accurately localised, into direct

contact with it. The drawbacks are its small magnetic power compared with the giant magnet, and therefore its inability to dislodge particles at all firmly imbedded, or to attract small particles unless brought into contact with them. There is danger also that in introducing the point within the eye infection may be carried in on it.

Supposing the particles of iron to have been localised in the eyeball, the method of operation will depend upon whether the foreign body is in the posterior or the anterior part of the eyeball, and upon whether the injury is old or recent. Taking a case with the wound still open or recently inflicted, and the foreign body in the anterior part of the globe, the operation of extraction is done as follows :—

The patient lies on the operation table, the eye is washed and anæsthetised and the magnet tip and other instruments sterilised. The surgeon stands at the head of the patient, holds the lids apart with his left hand, and holding the magnet in his right hand, applies it, with its blunt end on and the current open to the wound. If bulging is seen, attraction is being exerted, and the fragment may gradually come forward towards the wound in the cornea, or push the iris before it if more deeply situated. By moving the magnet point it may be possible to draw the particle from behind the iris through the pupil, though to do this the enlargement of the wound, the substitution of a longer point to the magnet, or the excision of a piece of iris may be necessary. In some cases from the obliquity with which the iron has entered it may be better to make a fresh wound over the fragment, rather than to pass the magnet tip in through the old wound.

Should the foreign body be lodged in the posterior part of the eye, in the vitreous or retina or chorioid, the hand magnet is useful, especially in recent cases when its point is introduced through the wound, enlarged if necessary for the purpose. Wound of the lens also makes this route the best and the lens matter may be washed out with the irrigator before passing the magnet point on into the vitreous. If the injury is recent, the particle free and not septic, this method is likely to be successful. Should the particle be known to be imbedded deeply in the retina, should the wound of entry have closed and should the lens be clear and uninjured, it is better to extract by the scleral route. The sclera is incised in a meridional direction as in posterior sclerotomy, as far as possible over the site of the foreign body, but avoiding the ciliary region and the *venæ vorticosæ*. A spot between the recti tendons and between the ciliary region and the equator of the eye is the proper place to make the incision. After the extraction the conjunctiva is sewn over it, the stitch taking up episcleral tissue as well, and both eyes are firmly bandaged so as to keep them entirely at rest to try and get the wound in the sclera to unite.

In old cases with the particle of iron deeply imbedded in the posterior part of the eye and especially where the fragment is of very minute size, the hand magnet may be unequal to the task of extraction. In such cases and indeed in many of the cases just described, the *giant magnet* will do good service. The difficulties in the way of using it are its great weight, its non-portability, its cost and the necessity of having a good supply of electricity, which is not always obtainable. The drawbacks of using it when available are that the iron may be so violently drawn to it that it tears through the various

structures, setting up irido-cyclitis, etc., and not infrequently becomes imbedded in the ciliary body, or by dragging on the retina causes a detachment of it. Moreover the point of the giant magnet cannot be passed in through any wound like the point of the hand magnet.

(2) *To use the giant magnet*, the patient is seated on a stool in front of it, with his eye on a level with the point,

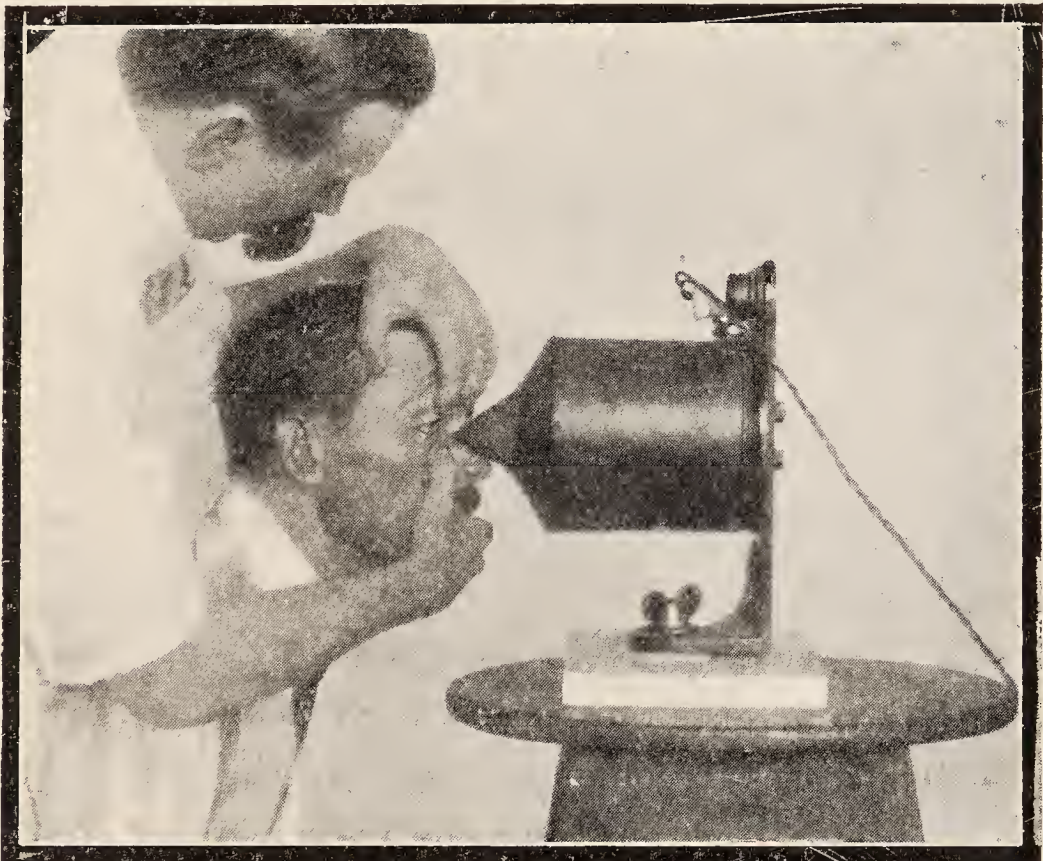


FIG. 91.—Extraction of iron foreign body by Haab's giant magnet. Bringing the cornea towards the magnet tip.

and at a distance of nearly two feet from it. The current is then switched on. The surgeon stands behind the patient with one hand holding the chin and the other the forehead, the fingers of that hand holding the lids apart. The patient's towel-covered head rests against the surgeon's chest, the latter slowly advances the patient's head towards the magnet, bringing the centre of the cornea towards the magnet tip (fig. 91). As this is done the patient often,

but not always, even where there is iron in the eye, complains of pain, and bulging may be seen, either of the cornea, or iris, or lens, or sometimes the whole eye is seen to be drawn forwards, and the patient withdraws his head forcibly in consequence of the dragging pain experienced. It is on account of this pain and because serious damage from too rapid withdrawal of the foreign body may occur, especially when as often happens we do not know the size of the particle, that the gradual approach of the eye to the magnet is recommended. Professor Haab who has done such excellent and original magnet work, places the magnet almost in contact with the cornea and then switches on the current in its full strength at once. This is certainly inadvisable in the case of particles of any size, and imbedded at any considerable depth, and with particles whose size we are totally ignorant of, at any rate in fresh and comparatively recent cases. In very old cases, however, it may be necessary to apply a series of jerks in this way by making and breaking the current in order to loosen the metal. When the particle ceases to come any further, the direction of the magnetic attraction must be varied so as to draw it round the lens or through the pupil from behind the iris. Once in the anterior chamber an incision is made through the cornea, if the original wound is healed, and the iron extracted. In the method shown in fig. 91 one of the fingers of the surgeon's upper hand may be extended to touch the magnet as the eye comes near the tip. This is advisable to prevent any risk of the eye coming forcibly in contact with the tip. Fig. 92 shows another method of advancing the patient's eye towards the magnet. The control over the head is not so good, but the view of the eye is better. In fig. 91 the patient should have been

steadying himself with his hands on the pedestal as in fig. 92.

It must be remembered that a foreign body may have perforated the eyeball and passed out posteriorly into the orbital tissues. An X-ray photograph will show this if it has happened.

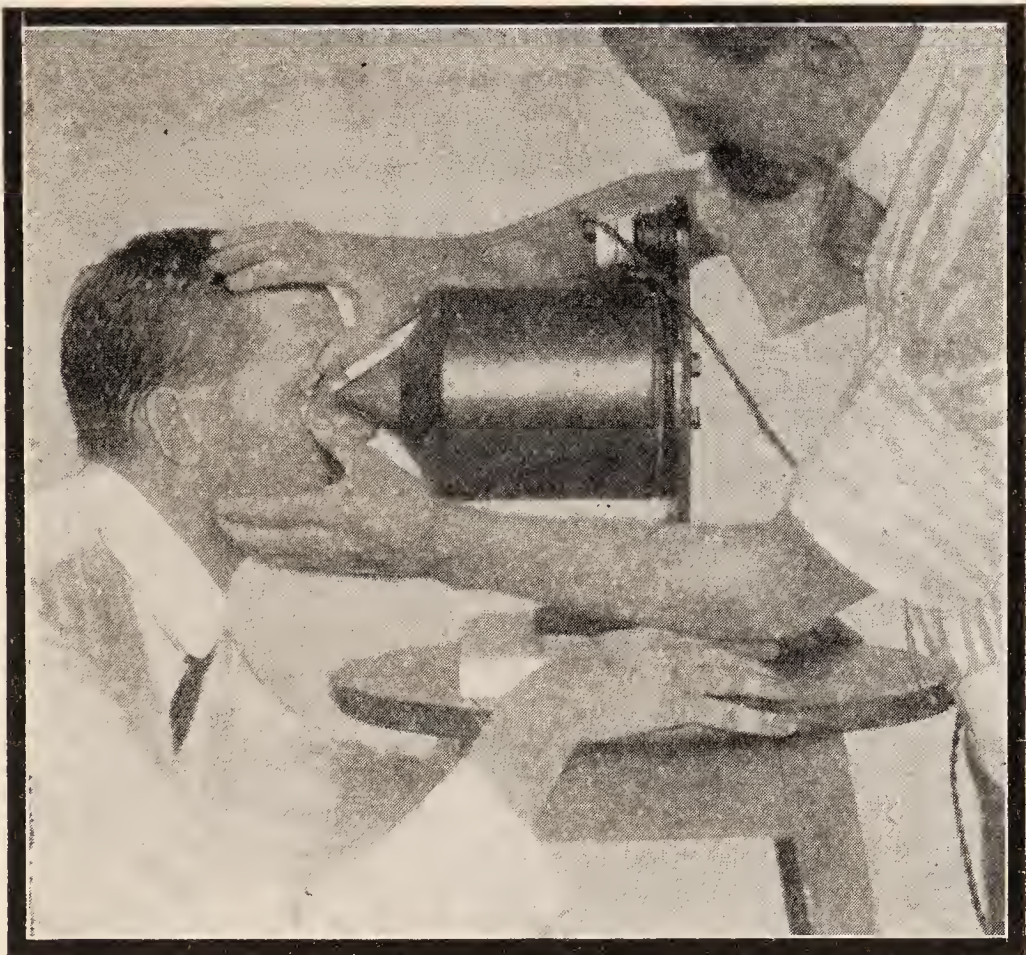


FIG. 92.—Extraction of iron foreign body by Haab's giant magnet—alternative method of approach.

Accidents :—These have been indicated in describing the operation. With the giant magnet the risk is that with foreign bodies of any size the piece of iron may tear its way too suddenly through important tissues and become fixed in the ciliary body, or may cause detachment of the retina. The hand magnet may fail to remove the foreign body, and there is a risk of its point introducing infection into the eye. These risks are best

avoided by a judicious use of both kinds of magnets and by a scrupulous regard for surgical cleanliness. The nature of the particle is of importance, a chip of red hot steel is less likely to be followed by infection than one of cold iron, though either may carry infection in from the surface of the eyeball. Subsequent infection through prolapsed vitreous is not uncommon. Should the foreign body prove impossible to remove, the loss of the eye is certain sooner or later—it may be many years later—however good the immediate result may seem.

After-treatment:—Complete rest in bed, iced compresses or small bags of powdered ice on the eye for some days, bandaging of both eyes, daily dressing and cleaning with biniodide lotion and the frequent application of atropine to the eye; “slop” diet and regular action of the bowels, are required. Complications are to be treated as they arise.

CHAPTER XIII.

ENUCLEATION AND ITS SUBSTITUTES.

Enucleation.

Indications :—At once for severe injuries causing great damage to the eyeball and complete loss of sight, or later if cyclitis follows with danger of sympathetic ophthalmitis; malignant tumours; absolute glaucoma; pseudo-glioma; staphyloma; panophthalmitis. When done for this last condition, there is a definite though remote danger of fatal meningitis following (1 in 1600 enucleations—de Schweinitz).

Instruments :—Clark's speculum (fig. 8), two retractors (fig. 34), strabismus hook (fig. 100), two pairs curved blunt-pointed scissors, one light for the conjunctiva and tendons and one heavy for the optic nerve (fig. 93), fixation forceps (fig. 9), curved needle, needle-holder (fig. 47 or 48), Spencer Wells' forceps, black silk suture thread.

Anæsthesia :—Local—may be used in adults where there is no reason to anticipate adhesion of the globe to Tenon's capsule, *i.e.*, in non-inflammatory cases, in cases of absolute glaucoma and early tumours. Also where they may be contra-indications to a general anæsthetic such as cardiac disease. Barker's solution is then used, or if adrenaline is contra-indicated, *e.g.*, by a high tension pulse, eucaine alone in a 2 per cent. solution may be used. The conjunctiva having been anæsthetised by the instillation of cocaine, ten minims of the solution are injected

along the insertion of each rectus muscle. Ten minutes later the operation may be begun, and will be painless,

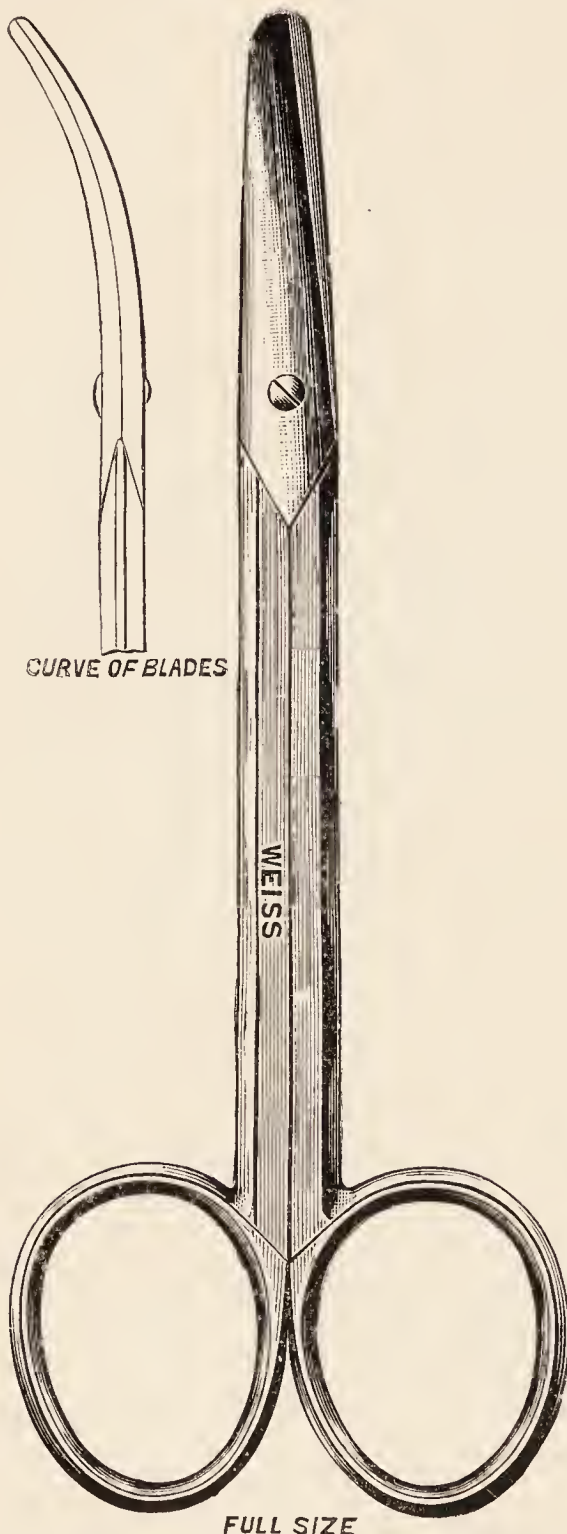


FIG. 93.—Strong scissors for cutting optic nerve in enucleation.

except sometimes when the scissors are passed behind the globe. A further injection in this situation may be made. Should the eyeball be soft and tender as it often is after irido-cyclitis, the solution may be injected into the vitreous humour through the sclerotic. This makes the eyeball harder and lessens the pain.

General anæsthesia is necessary in inflammatory cases and for tumours that have pierced the sclera.

Methods:—Before administering an anæsthetic a mark of some kind should be made over the eye to be removed or the notes of the case should be read out before operating. The sound eye has been removed more than once, and by good surgeons, where this precaution had not been taken, and it is not unlikely to

occur in cases of early tumour, where nothing distinguishes the eye externally, or of sympathetic disease where both eyes may appear inflamed.

The surgeon stands behind the patient's head for either eye. After inserting the speculum the conjunctiva is seized below the cornea and as near the corneal margin as possible, by the fixation forceps, and a snip in it is made with the light pair of scissors. One blade of these is then passed under the conjunctiva and this membrane is divided all round close to the corneal margin. This is more easily effected if the conjunctiva is picked up by the forceps applied beyond the scissors, and not between the scissors and the cornea as one sometimes sees done. The divided conjunctiva being held away from the globe by the forceps, the scissors are passed deeply between it and the globe as far back as just behind the insertions of the tendons, separating the globe as cleanly as possible all round from the surrounding tissues. This is a difficult procedure when there has been much inflammation, but it is important to do it thoroughly as it renders the next stage of the operation easy. This consists in the division of the tendons. The external rectus is taken up on the strabismus hook and divided between the hook and the globe. Next the internal rectus, which should be left about $\frac{1}{8}$ inch long. Then the inferior rectus with which the inferior oblique is unconsciously divided, and finally, the superior rectus and the superior oblique. On unscrewing the speculum and pressing it towards the apex of the orbit, the globe usually starts forward and projects between the lids. Should it be too large to do this, the external canthus may require division and subsequent suture.

The insertion of the internal rectus which has been left long for the purpose is now seized by fixation forceps and the globe drawn directly outwards. The heavy curved scissors are passed deeply into the orbit on the inner side and opened to enclose the optic nerve, which is put on

the stretch by the outward rotation and so is easily felt, and by a firm cut the nerve is divided (fig. 94). If the globe should have been drawn *obliquely* outwards and upwards or downwards, the nerve may not be hit off and



FIG. 94.—Enucleation of right eye, globe extruded by pressure on speculum, and rotated outwards by forceps holding stump of internal rectus. Scissors, steadied by forefinger on shaft, about to divide optic nerve.

the scissors may cause unnecessary bleeding. The globe then starts out still more, and, after division of any remaining tissue, can be removed. After a neatly done operation no tissue should be seen on it beyond the stump of the internal rectus and as much of the optic nerve as it was decided to remove. In malignant disease and in sympathetic ophthalmitis this should be divided far back. The

wound is then well irrigated with mercuric iodide solution, 1 in 5000, the opening in the conjunctiva is sewn up with a purse string suture, and a pad and bandage applied. The suture should not be applied if enucleation has been done for any septic condition. In such cases a gauze drain may be necessary.

In Arlt's operation for enucleation no strabismus hook is used, but the inner rectus tendon of the right eye (outer rectus of the left) is exposed, seized with fixation forceps and cut long. The tendon stump is then used to rotate the globe as is necessary, while the different tendons are successively divided by straight scissors and the operation completed as above described.

Accidents :—At the beginning of the operation the speculum may keep coming out, especially in cases where the lids have been much stretched, *e.g.*, by a large staphyloma. Retractors may be substituted. The lid margins may be cut during the division of the conjunctiva if carelessly done. Unless the undermining of the conjunctiva is done thoroughly, there is apt to be difficulty in lifting the tendons on the hook, and instead one sees bits of tissue fished up and unnecessary mutilation and delay. Cutting into the globe should not occur ordinarily, but may happen in soft eyes and cause much difficulty in completing the operation. On dividing the optic nerve much hæmorrhage may follow. Pressure usually stops this, but every now and then a ligature is needed. Occasionally in elderly subjects vigorous hæmorrhage occurs the moment the heavy scissors are closed and the globe removed. The orbit appears to fill with blood pushing the eyelids tightly forwards. If the clots cannot be turned out, pressure may be applied over the lids and no harm beyond a prolonged 'black-eye' results. The

application of a 'tobacco-pouch' suture along the conjunctival opening helps to stop bleeding and shuts off the wound cavity from the air. Should hæmorrhage continue inside the wound cavity, it is of no consequence unless septic (and in cases where asepsis cannot be attained no suture should be used) ; indeed the organisation of any clot formed has appeared to make a better stump. Sewing the tendons to one another either in opposite pairs alone or together with the conjunctiva does not appear to make a better stump, but in fact to make a rather less movable one, by inserting the tendons, already on the stretch, further forwards. In other words the stump is withdrawn further into the orbit.

After-treatment :—The dressing should be changed daily and the conjunctival sac washed out with a mild antiseptic lotion. The suture may be removed on the fifth or sixth day. It is advisable to begin the use of an artificial eye, or at any rate a shell, on about the tenth day for an hour or two a day, gradually increasing this time to get the sac used to the eye and to prevent shrinking.

Mules' Evisceration.

Indications :—Severe injuries with loss of sight in which the sclera is not too damaged to allow of the insertion of an artificial vitreous ; staphyloma ; sympathetic ophthalmitis, instead of enucleation : the safety of evisceration in these cases is disputed, but the cases collected show them to be of equal safety.

Instruments :—Speculum (fig. 8), two retractors (fig. 34), Graefe's knife, curved blunt-pointed strabismus scissors (fig. 101), fixation forceps (fig. 9), Mules' evisceration scoop (fig. 95), (or Volkmann's spoon), Mules'

introducer (fig. 96), three glass globes of sizes (artificial vitreous) (fig. 97), three curved suture needles, needle-

holder (fig. 47), white and black silk suture thread.

Anæsthesia :—General.

Methods :—In Mules' operation the cornea is cut away, the contents of the globe are removed, and an artificial vitreous is inserted into the scleral cup remaining. The speculum is introduced and the conjunctiva divided all round near the limbus as in the first step of enucleation. It should be dissected back from the globe for half an inch to allow the conjunctiva to be brought well over the scleral wound later on. A Graefe's knife with its edge up is then made to transfix the globe



FIG. 95.—Mules' evisceration scoop.



FIG. 96.—Mules' introducer.

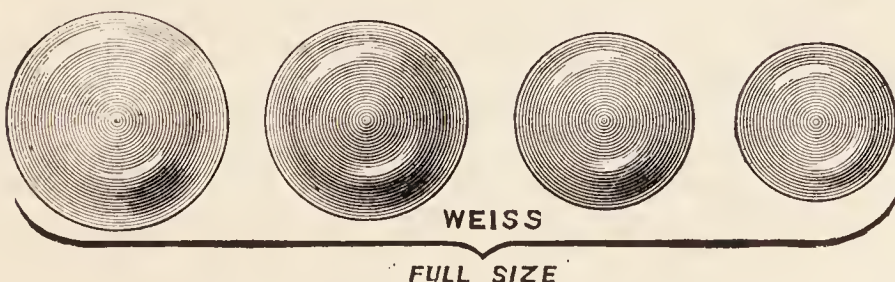


FIG. 97.—Mules' glass globes—four sizes.

from side to side just posterior to the plane of the limbus. It is cut upwards in the same plane, thus forming a large

flap composed of the upper half of the circumference of the cornea and sclero-cornea. The iris would be in the flap if it were in its normal position which of course it rarely is. The scissors are then used to carry the incision round the lower half of the circle and the result is a large circular opening through which vitreous and the lens if it is present appear. The scoop is next used to clean out the contents of the globe, vitreous, retina, chorioid and ciliary processes, until the inside of the sclera shows clean white everywhere. The opposite edges of the scleral opening next have triangular bits cut out by scissors so as to make the opening pointed at either end horizontally and facilitate subsequent suturing.

A good deal of bleeding occurs during the scooping out process, especially from the optic disc, and it is necessary to stop this thoroughly by stuffing the scleral cup tightly with gauze soaked in adrenaline solution before proceeding further.* After the bleeding has ceased a glass globe judged to be of the right size is introduced by Mules' introducer. If this is not available, the edges of the cup may be held open by forceps, while the globe is slipped in. Too large a globe is not to be chosen and unless the scleral margins can be drawn over it so as to meet easily, it should be rejected and a smaller one chosen. After its introduction the edges of the scleral opening are united in the horizontal meridian by four or five interrupted sutures passed from below upwards. To obtain firmer flatter union the sutures may be passed in such a way that the lower edge of the sclera lies flat on the upper. The suture is passed in from without inwards

* The author once had to apply pressure forceps to the central retinal artery on the disc for some time before the bleeding was controlled.

first through the lower and then through the upper edges of the wound, then it is returned from within outwards, through each layer. On drawing the suture tight the interior surface of the lower edge lies flat on the external surface of the upper edge and in firm apposition with it. (Weeks). The conjunctiva is now brought together over the scleral wound either by interrupted sutures placed in a line at right angles to that of the scleral sutures or by means of a purse string suture. It is a good thing to use black silk for the conjunctival and white for the scleral sutures, so that later on if the scleral sutures which should remain buried come away, they are recognised as such. If different coloured silks are used too, there is no danger of catching hold of the scleral sutures, which are sometimes visible through the conjunctiva, when removing the conjunctival sutures.

The openings may be united in the opposite meridians to those given, *i.e.*, the sclera vertically instead of horizontally, but the author considers from an experience of nearly thirty operations that the movements are better when the sclera is united horizontally.

Accidents :—Hæmorrhage has been dealt with. It can rarely be serious though it is often annoying and takes time to stop. Not infrequently a glass globe which appeared all right is found after sterilisation to contain liquid, showing that it is cracked. It should be rejected. For this reason and for choice of size it is as well to sterilise at least three globes of different sizes.

After-treatment :—Iodoform or boracic acid powder is dusted into the conjunctival sac, a good pad applied and both eyes bandaged. An ice bag is applied over the eye operated upon for the first forty-eight hours and the patient kept in bed a week with both eyes bandaged if

possible. Dressings are changed on the third day, daily after. There is generally considerable chemosis though rarely much pain and only slight fever afterwards. Touching the chemosed conjunctiva with sulphate of copper is useful at the end of a week. The conjunctival stitches need not be taken out for eight or nine days, the scleral not at all of course. Should perfect asepsis not have been obtained or the globe have been too large or bleeding have occurred, the wound may open and the globe show gradually more and more until it comes or is taken out. Restitching the wound over it is useless and it had better be removed. The resulting stump is even so decidedly better than after enucleation. Fracture of the glass globe is theoretically possible but has not been recorded. Silver may be used instead of glass. Aluminium darkens the tissues but is light and otherwise not objectionable. Hard paraffine is not a satisfactory substitute for glass.

Frost's Operation.

Indications :—The same as for Mules' operation. It may be used also for malignant tumours which are still confined to the globe.

Instruments :—As for enucleation, with Mules' globes.

Anæsthesia :—As for enucleation. Local injection suffices.

Method :—Enucleation is performed in the usual way, and on removal of the globe bleeding is stopped by pressure. The glass globe is then placed in Tenon's capsule and the conjunctiva quickly sewn over it. The sutures should be passed in deeply so as to hold well and quickly to prevent blood collecting. The conjunctiva may be

drawn over the globe and held there by forceps while the sutures are inserted.

The after-treatment is the same as after Mules' operation. Extrusion of the globe is commoner.

Optico-Ciliary Neurectomy.

Indication :—In cases of absolute glaucoma with severe attacks of pain in which the patient refuses enucleation or Mules' operation.

Instruments :—As for enucleation together with an advancement forceps (figs. 102, 103).

Anæsthesia :—General is necessary.

Method :—The speculum being inserted a vertical incision is made through the conjunctiva and Tenon's capsule along the inner side of the cornea, over the insertion of the internal rectus muscle as in a tenotomy for squint, but the incision is made longer. A strabismus hook is passed under and along the tendon to free it. A silk suture is then passed through the tendon from its deep surface emerging at its middle line about half an inch from its insertion. This is tied firmly round the tendon's upper half and the end of the suture left long. A similar suture is applied to the lower half. The tendon is now divided between the sutures and its insertion.

Catching hold of the tendon insertion with forceps the globe is rotated outwards and the curved strong scissors passed in close to the globe until the optic nerve is felt. This is divided far back half an inch or more from its entry into the sclera. The piece of optic nerve left is seized and cut off close to the globe, and the scissors are swept round the back of the eyeball, dividing the ciliary nerves in the process. The two ends of the

internal rectus muscle are then reunited by passing the sutures through the insertion and tying them.

The conjunctival wound is sutured. As there is generally some proptosis from retro-bulbar hæmorrhage it is a wise precaution to sew the lids together before applying a pad and bandage, to restrain the hæmorrhage and protect the cornea.

Accidents :—The stitches may pull out from the tendon. If they do this in spite of firm tying, the tendon insertion should be sutured to Tenon's capsule and conjunctiva instead. Hæmorrhage may be severe. Pressure will stop it.

After-treatment :—The lids should be kept sutured for three or four days, and the eye bandaged for several days more, until corneal sensation returns, which usually happens after ten or fourteen days. All pain due to the glaucoma usually disappears at once, but proptosis from bleeding may cause pain of a different character for a few days.

Artificial Eyes.

Two kinds of artificial eyes are in use—the old hollow shell and Snellen's 'reform' eye. The latter is a double-hollow shell and more completely fills the sac, and so moves better than the former. In either case certain rules are to be observed if satisfaction is to be obtained in wearing them. The eye must never be too large, the lids should always be able to close over it completely. Patients dislike the sunken appearance of an eye that is small enough and do not realise the staring appearance and immobility of one that is too large. The large one also sets up irritation and discharge of mucus with subsequent shrinking of the sac. The eye must be removed every night and washed and dried carefully.

To obtain an eye that is comfortable and the right size, especially after Mules' operation, when eyes small enough can rarely be obtained, (a small enough shell, that is, with large enough iris and pupil), a cast of the sac in plaster of Paris may be taken as follows. The sac has cocaine instilled and then is rubbed all over inside with vaseline and the edges of the lids and lashes are well covered with it. The lids are held open and about a teaspoonful of dry plaster is poured into the sac. A few drops of cold water are then dropped in and mixed with the powder with a glass rod ; more powder and more water are added until a paste is formed filling the sac. It is shaped with the rod and the lids must be able to shut completely over it. After about a quarter of an hour the case will have hardened and may be removed carefully. Standing in front of the patient, who up till now has been lying down with the surgeon behind his head, the outline of the iris and pupil are drawn on the cast corresponding to the other eye, or a piece of paper on which the other iris and pupil have been drawn or painted may be gummed on later to the place marked at the time.

After removal it is as well to cover the cast with wax. The great difficulty in the process is excessive lacrymation. On this account it may sometimes be necessary to try more than once before obtaining a satisfactory cast. The cast may be sent to an optician, and an artificial eye made from it as a pattern. The result is better than with an eye selected from a box. It is more expensive also, not quite doubly so.

CHAPTER XIV.

OPERATIONS IN THE ORBIT.

ABSCCESS—REMOVAL OF TUMOURS—EXENTERATION— KRÖNLEIN'S OPERATION.

Abscess.

ABSCCESS may result from orbital cellulitis, tenonitis, periostitis or caries of the bones bounding the orbit, thrombosis of the cavernous sinus, or after injuries, especially perforating injuries with lodgment of foreign bodies. The pus is under great tension but fluctuation is finally felt on pressure deep between the eyeball and the orbital margin, or through the conjunctiva in the fornix. An incision should be made, without waiting for fluctuation, through the upper lid with the flat of the knife in the plane of the orbicularis fibres, and the point directed so as to pass between the bone and the eyeball without wounding the latter. On turning the knife edge laterally pus will escape alongside it if present, or the knife may be withdrawn and a pair of dressing forceps passed in and then opened (Hilton). Too early an opening is much better than too late, as irreparable damage may be done to the sight from the proptosis and stretching of the optic nerve.

A gauze drain should be inserted, a suitable antiseptic dressing applied, and the wound dressed daily until healed.

Removal of Tumours.

Tumours in the anterior part of the orbit lying to one side of the globe or not extending far back may be removed from in front by orbitotomy. An incision along the lid, through and parallel to the fibres of the orbicularis, exposes the tumour which dissection shells out. Or the incision may be made through the fornix. If necessary the external canthus may be divided to make access easier, the divided lids being sewn together after the operation is completed. If the globe is involved in the tumour, exenteration (*q. v.*) will be necessary if it be malignant. If there is any chance of saving the eye and yet the tumour cannot be removed from in front, Krönlein's operation is the most suitable (*q. v.*).

Exenteration.

Indications :—Complete removal of all the contents of the orbit is indicated in intraocular tumours that have extended beyond the limits of the eyeball or that have recurred after enucleation ; also for tumours in the orbit that have involved the eyeball in which it is impossible to save the globe.

Instruments :—As for enucleation, with Volkmann's spoon, and Langenbeck's periosteal raspatory.

Anæsthesia :—General.

Method :—The external canthus is divided as far as the bone and the two margins of the incision held wide apart by sutures passed through them and held in Spencer Wells' forceps. The conjunctiva is then divided all round the corneal margin, dissected back from the globe and held open by retractors. This is sometimes difficult owing to inflammation and is inadmissible if the conjunctiva is involved in the new growth. It must then be divided

nearer the fornix. The knife is then carried through the soft parts and periosteum down to the bone of the orbital margin. The contents of the orbit are separated from the bone by the raspatory, aided if necessary by scissors, further and further in until the mass of eyeball and tumour remain only attached at the apex near the optic foramen ; much care is needed in separating over the thin ethmoid not to perforate it. The strong scissors are then used to cut through the remaining connections, and the mass comes away, with free hæmorrhage. Pressure with gauze swabs is used to control this, and if necessary the orbit may be packed with gauze after thorough flushing with biniodide lotion. The outer canthus is then sewn up with silkworm gut sutures, and the conjunctival sac is left open with a gauze drain for escape of discharge and withdrawal of the gauze, should any have been used for packing. A pad is applied and the eye firmly bandaged.

Accidents :—The globe may rupture during removal but this is of little consequence, provided the wound is well flushed afterwards. Bleeding may be severe but rapidity in operating lessens the amount of blood lost, and it is controllable by pressure after removal of the orbital contents.

After-treatment :—Unless the temperature rises or the pain is severe, the wound is better not dressed for three or four days. Then the gauze drain and the packing are removed, and a simple pad and bandage applied with daily cleansing thereafter. The stitches are removed from the external canthus when it is healed at the end of a week. If it is desired to wear an artificial eye Thiersch's skin grafting into the wound may be necessary. If either or both lids have had to be removed, the orbit will have to be closed with grafts.

Kronlein's Operation.

Indications :—Domela-Nieuwenhuis* gives the following conditions in which Krönlein's operation is indicated : (1) Cysts of all sorts ; (2) tumours of the optic nerve and its sheath ; (3) retro-bulbar cavernous angioma and lymphangioma ; (4) other retro-bulbar tumours, osteoma, sarcoma, etc. ; (5) retro-bulbar injuries, especially if septic infection has probably or certainly taken place, or if a foreign body is present ; (6) retro-bulbar phlegmon, since treatment by simple incision is so unsatisfactory, many of the patients dying, and some surviving but with loss of sight ; (7) Graves' disease, when the exophthalmos is sufficient to prevent closure of the lids, some of the orbital contents may be removed ; (8) to assist in the performance of posterior sclerotomy, as when cysticercus is present in the immediate neighbourhood of the disc or posterior pole ; (9) in aneurism of the orbit to enable the whole sac to be removed ; (10) when in any case of choked disc it has been decided in the interests of vision to open the nerve sheath ; (11) for diagnostic purposes in some doubtful cases. If the eye is already destroyed or so involved that saving it is impossible then exenteration is to be preferred, but if there is any doubt Krönlein's is the better operation.

Instruments :—Scalpel, two retractors, spatula, strong curved and straight blunt-pointed scissors, six pairs Spencer Wells' forceps, sharp hook, chisel (narrow and sharp), mallet, periosteal raspatory (Langenbeck's), Hey's or Adam's saw or keyhole pattern saw. If available a dental engine or small motor driving a circular or narrow

* *Beiträge zur klinischen Chirurgie*, Tübingen, ii & iii, 1900, ably abstracted in the *Ophthalmic Review*, Vol. XX, 1901, p. 7, by Dr. W. G. Sym.

longitudinal saw is useful. Curved suture, needles, silk-worm gut, silk sutures.

Anæsthesia :—General.

Method :—The eyebrow should be shaved, also the hair on the temple if it reaches far forward. The area of the operation and the conjunctival sac are disinfected. A curved incision, two inches long in the adult, with the convexity forward, is made beginning above at the front end of the temporal crest a quarter of an inch above the margin of the orbit, passing downwards a quarter of an inch external to the outer canthus, and crossing the zygoma to end at a point midway between the external canthus and the tragus. This incision divides skin and orbicularis throughout and at its centre reaches the bony margin of the orbit where the orbital fascia and periosteum are cut down to the bone. The superficial surface of the malar bone should be clearly exposed also. The raspatory is introduced and the periosteum separated freely from the outer wall of the orbit so as to expose the whole of the orbital surface of the malar bone and the anterior end of the speno-maxillary fissure. The three divisions of the bone are next taken in hand, the orbital tissues being held well inwards with the spatula while the bone is divided.

Two of the divisions are horizontal (in the erect position of the body) and one almost vertical (fig. 98). The first divides the external process of the frontal bone at its base and extends horizontally through it for half an inch, *i.e.*, as far as the zygomatico-sphenoid suture. This is best done with a saw, and the periosteum must be divided with a scalpel before the saw is applied on the orbital aspect of the bone, both in this and in the other divisions of the bone.

The second division is almost at right angles to the first and extends downwards from its inner (posterior) extremity just beyond the zygomatico-sphenoid suture to the anterior corner of the speno-maxillary fissure. This is best done by means of a chisel.

The third division cuts through the base of the frontal process of the malar bone. It is parallel to the first and ends in the speno-maxillary fissure like the



FIG. 98.—Krönlein's operation. Front view of skull with lines of the three bone sections marked in ink.

second. It is best made with a saw. The osteoplastic flap thus fashioned measures about three-quarters of an inch square and is covered with soft tissues on its temporal surface. It is bent outwards freely exposing the orbital contents which are covered with the reflected periosteum. This periosteum is divided longitudinally with scissors and drawn aside exposing the muscles, etc., in natural position or distorted according to the condition for which the operation was undertaken. If possible the external rectus

muscle is drawn aside and saved, but if that is impossible it is seized by two sutures near its insertion for subsequent re-union and divided between them. The tumour or other condition is dealt with as required, and after reuniting the rectus muscle if divided, the osteoplastic flap is replaced, the periosteum being stitched, and after the insertion of a small horse-hair drain brought out at the lower end of the wound—not always necessary—the skin wound is brought together with silkworm gut sutures. There is sometimes proptosis from hæmorrhage and it is a wise precaution to sew the lids together. An ordinary dressing and bandage are then applied. Or, if no drain has been used, the wound may be sealed with iodoform varnish and a fine shred of absorbent wool.

There have been various modifications in the operation. In Krönlein's original operation the piece of bone separated was triangular with its apex at the anterior end of the spheno-maxillary fissure. The quadrilateral section given above serves the purpose better. Parinaud and Roche make the incision shaped with the vertical limb in the hair in the temporal region, and the two horizontal limbs forwards. This is said to leave a less noticeable scar, to give more room, and to exclude infection from the conjunctival sac more safely.

Accidents :—Proptosis may result from hæmorrhage ; ulceration or sloughing of the cornea may occur as the cornea is usually anæsthetic from division or destruction of the ciliary nerves, and if there is proptosis also the lids do not cover the cornea sufficiently. For these reasons the lids should be sewn together and kept closed for a few days. Infection of the wound from the conjunctival sac is only likely to occur if the sac has had to be opened for any reason, *e.g.*, if the attempt is first made to remove.

the tumour in the usual way from in front by dividing the canthus, and it is then found necessary to do a Krönlein.* In such a case the canthus had better be sewn up before proceeding with the operation if there is any reason to suppose the conjunctival sac is capable of infecting the wound, otherwise the division of the canthus is of use in exploring the bony parts and can be sewn up later. Exophthalmos and limitation of movements, especially outward rotation, may be found later on. They are usually unavoidable and are a small price to pay for the preservation of the eyeball and often the sight as well.

After-treatment:—The drain can be removed after twenty-four hours. The stitches after a week. Daily dressing is unnecessary after the drain is removed as long as an aseptic course is pursued, as it usually is.

* See "ORBITAL SARCOMA: KRÖNLEIN'S OPERATION," in *Ophthalmic Review*: 1904, p. 156, for a case of the author's in which this occurred.

CHAPTER XV.

SQUINT OPERATIONS : TENOTOMY—ADVANCEMENT.

Indications :—In concomitant squint no operation should be done until refractive errors have been corrected, and exercises, including fusion-practice by means of stereoscopic images, have been given a good trial, say for a year. These measures are more likely to be of service in convergent strabismus dependent on hypermetropia than in divergent strabismus. In paralytic squint they are of no use, and when the treatment of the cause (syphilis, etc.) and the use of the battery fail, in such cases operation may be considered after the lapse of a year. As regards age, it is inadvisable to operate before the sixth year when the child has acquired some self-control, and the hope of the restoration of binocular vision is not yet necessarily abandoned. As regards the degree of convergent strabismus demanding operation, the rules given by Sir Henry Swanzy are useful. “If the vision of the squinting eye be fairly good, and the deviation amount to not more than 15° or 20° , and the power of the external rectus be sufficient, the correction can be effected” by tenotomy of the internal rectus of the squinting eye. “If the vision of the squinting eye be fairly good, and the power of the external rectus sufficient, and if the squint be more than 20° , it is advisable to divide the proceeding between the eyes—*e.g.*, if it be 30° , about 15° to 20° are corrected by tenotomy of the internal rectus of the squinting eye, and the remainder by tenotomy of the

internal rectus of the fixing eye.” “If, although the vision of the squinting eye be good, and the deviation not more than 20° or 25° , there be marked loss of power of the external rectus muscle, tenotomy of the internal rectus must be combined with advancement of the external rectus of the squinting eye.” “With a deviation of 30° to 35° , and loss of power in the external rectus, the demand for advancement of the external rectus becomes more imperative.”

In divergent strabismus, when the wearing of the proper glasses fails, as it generally does except in recent cases, advancement of one or both internal recti will be required, combined with tenotomy of the external recti if the power of abduction be greater than normal.

In paralytic strabismus advancement of the paralysed muscle, with tenotomy of its opponent if necessary, may be performed.

Tenotomy.

Instruments :—Clark’s speculum (fig. 8), fixation forceps (fig. 9), Guthrie’s double sharp strabismus hook (fig. 99), flattened strabismus hook (fig. 100), straight blunt-pointed strabismus scissors (fig. 101), half curved suture needle, silk needleholder (fig. 47 or 48).

Anæsthesia :—Except in children, in whom chloroform may be necessary, local anæsthesia by cocaine is enough. The use of adrenaline slightly increases the action of the cocaine and blanches the tissues with



FIG. 99.—Guthrie's double hook.

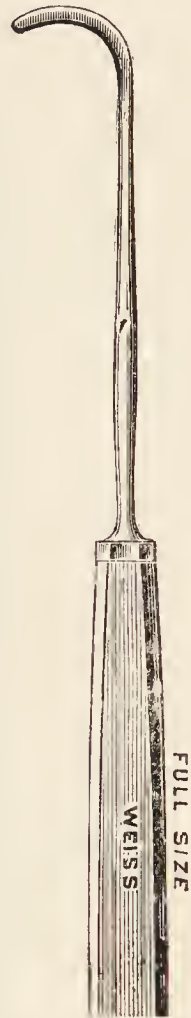


FIG. 100.—Flattened strabismus hook.

advantage. The great value of the local anæsthesia is that the action of the muscles is not suspended and the effect of the operation can be judged at once, and increased or diminished accordingly.

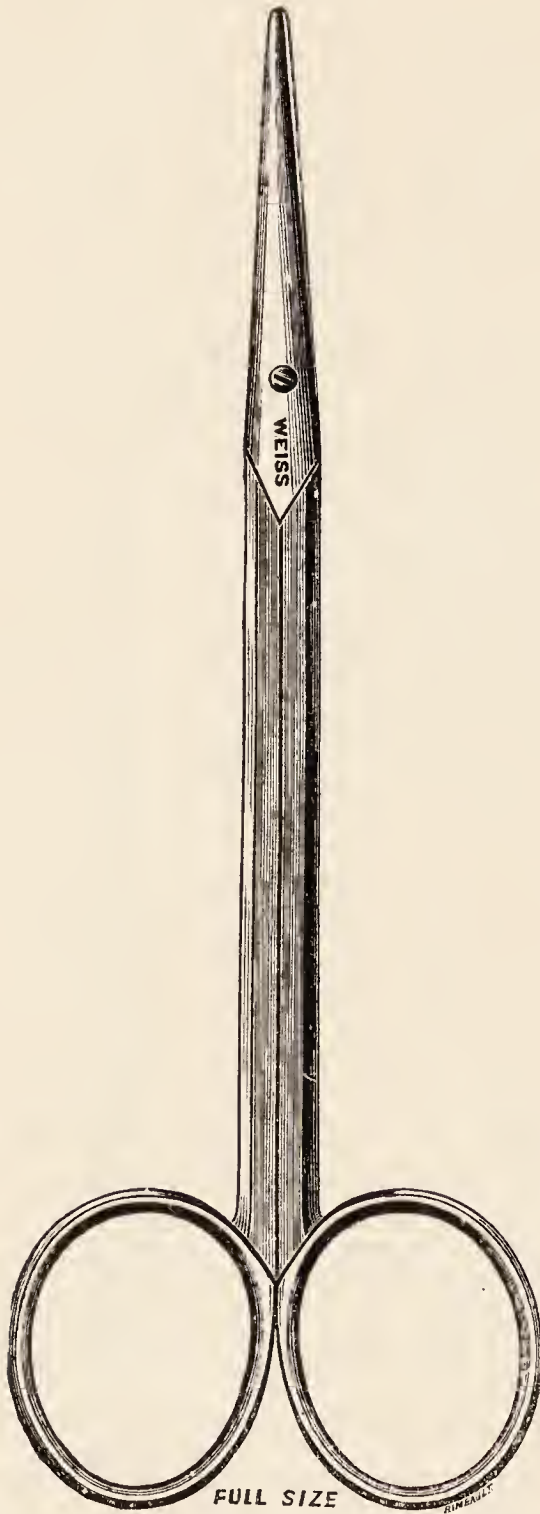


FIG. 101.—Strabismus scissors.

Methods :—(a) Graefe's.

The patient is lying down with the eye anæsthetised and the speculum applied. In operating on the internal rectus tendon the surgeon stands behind the head for the right eye, and to the left side facing the patient for the left eye, so as to have the scissor points towards the tendon to be divided. (If the surgeon is ambidextrous *with scissors*, he may stand at the head for either eye.) The conjunctiva is seized with fixation forceps midway between the corneal margin and the insertion of the tendon, and an opening through it and to the outer side of the forceps is made with the scissors. This opening is enlarged a little upwards and downwards and the conjunctiva is well undermined with snips of the scissors

backward over the insertion of the tendon, cutting more freely towards the upper edge of the tendon in the left eye and the lower edge in the right eye.

Holding the conjunctiva with the forceps in the left hand, the strabismus hook is passed into the wound as far as the tendon, with its point held against the sclera until the edge of the tendon is felt, when it is turned round beneath it and the tendon is thus lifted up on it. The whole breadth of the tendon should be raised on the hook as near its scleral insertion as possible. The hook carrying the tendon is then held in the left hand and the scissor points are made to snip through the tendon between the hook and the globe, cutting towards the back of the hook and not towards its point, as doing it the latter way tends to push the tendon off the hook. The hook is passed beneath the tendon in different directions to make sure there are no bands left undivided. If any are found they are divided. Guthrie's hook may be used to rotate the globe and put them on the stretch. The effect of the operation should be immediate, and if motion of the eye in the direction of the tenotomised muscle is not impaired, some band must have been left and should be sought for and divided. If the internal rectus has been divided, enough convergence should remain for the patient to fix the finger held six inches from the eyes. The wound is left unsutured if the effect is all that is desired. If the effect is excessive it may be diminished by applying a suture including Tenon's capsule and conjunctiva.

(b) In *Arlt's* method the strabismus hook is merely used for ascertaining if any bands have been left undivided after division of the tendon, which is accomplished by seizing the tendon with the fixation forceps instead of by raising it on a hook.

Accidents:—Wound of the globe may occur as the sclera is very thin under the tendinous insertions—

0·2 mm. sometimes. For this reason also sharp-pointed scissors must never be used. Too extensive division of the tissues with scissors is liable to be followed by sinking in of the caruncle or by some proptosis. It is useful to remember that the distance of the tendinous insertions of the recti muscles from the corneal margin is : internal 5 mm., inferior 6 mm., external 7 mm., and superior 8 mm. (Haab).

Hæmorrhage is lessened by using adrenaline, and beyond causing a 'black eye' for about ten days, is of no consequence.

After-treatment :—Both eyes are better bandaged for a few days, or if the squint is of refractive origin, they may be kept open and the correcting glasses worn at once. If the effect has not been as much as desired the patient may be instructed to keep the eyes turned away from the tenotomised muscle as much as possible during the first few hours while re-attachment is taking place.

Advancement.

Instruments :—As for tenotomy, together with Prince's strabismus forceps (right or left, figs. 102 and 103), needleholder (Galezowski's, fig. 48, or Weiss', fig. 47), six curved needles, and fine silk sutures.

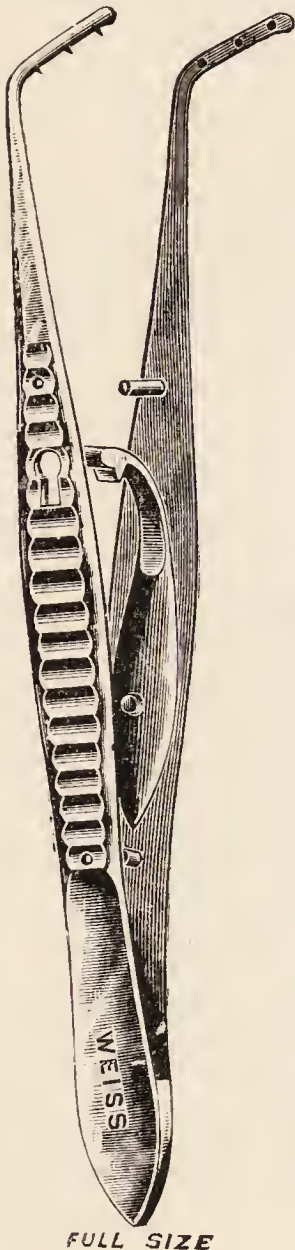
Anæsthesia :—As for tenotomy.

Method :—Fourteen methods invented by different surgeons are described by Haab, a sure indication of the difficulties met with. The following is Worth's operation which is a satisfactory one.*

A vertical incision half an inch long is made in the conjunctiva as in the operation for tenotomy, but a little nearer the cornea. The capsule of tenon is divided to

* *Diseases of the Eye.* May and Worth. Baillière, Tindall and Cox. 1906, p. 365.

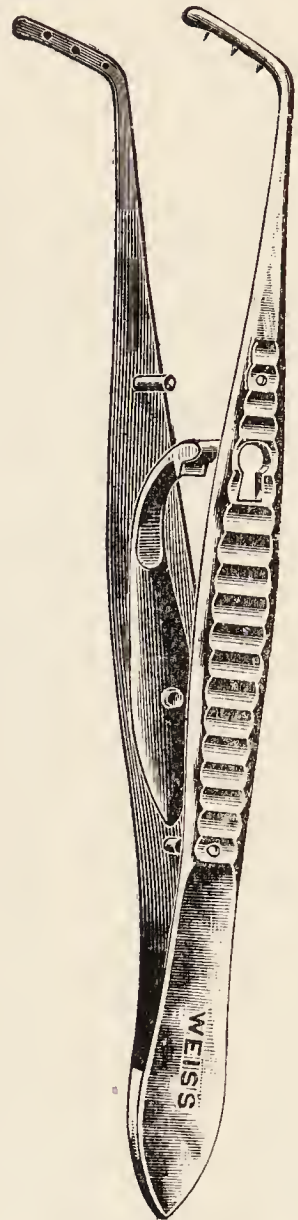
the same extent. The conjunctiva and capsule are then raised to expose the tendon insertion. If the squint is of high degree the conjunctival incision is made curved with its convexity towards the cornea to allow the mem-



FULL SIZE

FIG. 102.—Prince's advancement forceps.

branes to retract more freely. "One blade of the advancement forceps is now passed under the tendon after the manner of a tenotomy hook, the other blade being superficial to the conjunctiva. The forceps is now closed so that tendon, capsule of tenon, and conjunctiva are all firmly clamped together, with their relation undisturbed except for the retraction of the membranes. The tendon and a few little fibrous



FULL SIZE

FIG. 103.—Prince's advancement forceps.

bands beneath the tendon are now divided with scissors at their insertion into the sclerotic. The advancement forceps, holding the tendon, capsule, and conjunctiva, can now easily be lifted up so as to get a good view of the under side of the muscle (fig. 104).

One of the needles is then passed inwards at A, through conjunctiva, capsule, and muscle, and brought

out at the under side of the muscle. It is then again passed through muscle, capsule and conjunctiva (from within outwards) and brought out at B. The bight of the thread thus encloses about the lower fourth of the width of the muscle, together with its tendinous expansion and capsule and conjunctiva. The other needle is similarly entered at A', passed through conjunctiva, capsule and

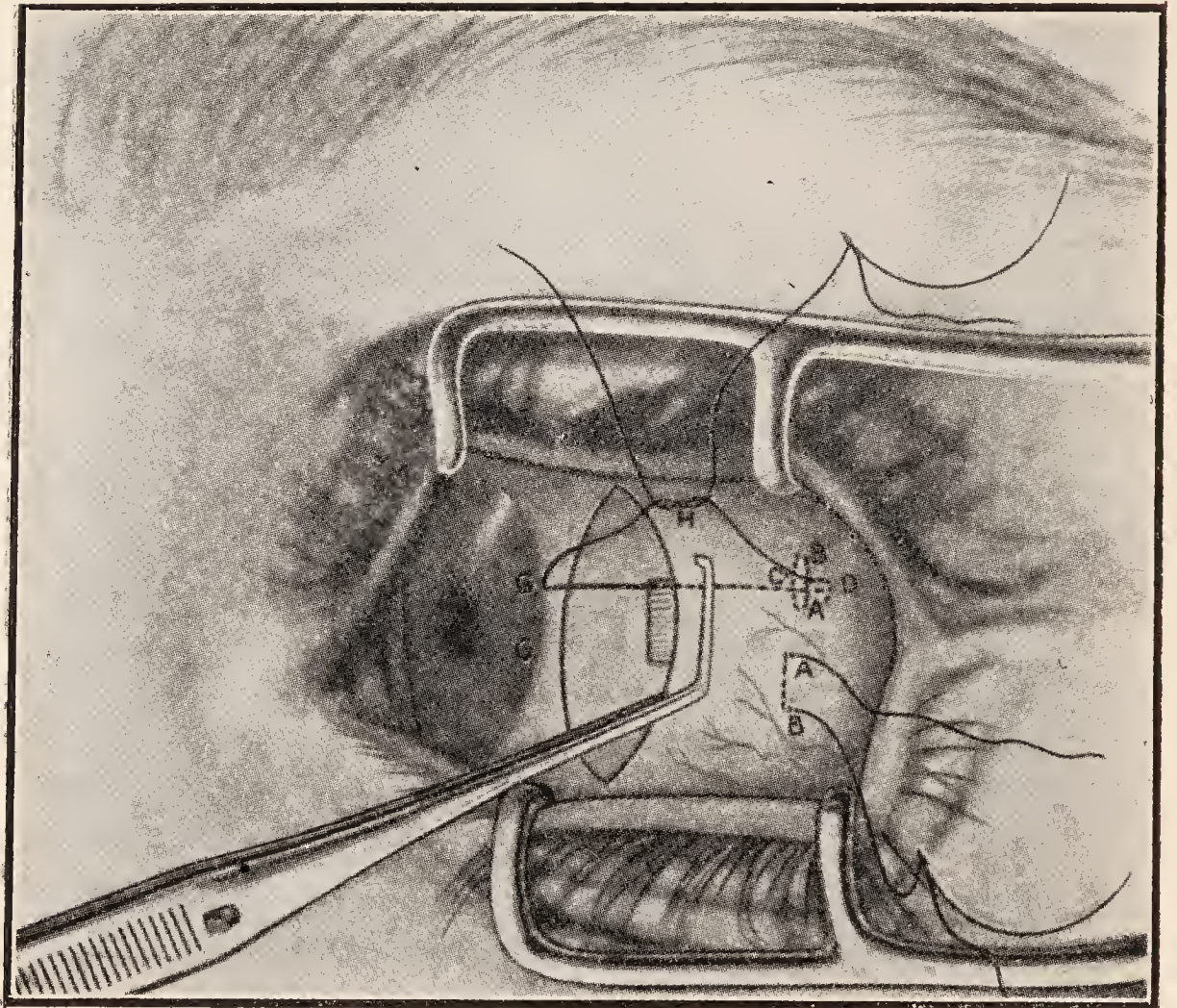


FIG. 104.—Worth's advancement operation (May and Worth).

muscle, and brought out at the under side of the muscle. It is then entered again at the under side of the muscle and brought out through the conjunctiva at B', the bight of this suture thus enclosing the upper fourth of the width of the muscle, etc. The object of inserting both sutures before proceeding further with either, is that, they may be

symmetrically placed. The ends of the thread from A' and B' are then knotted tightly at C. The end bearing the needle is then entered at D, and passed through conjunctiva, capsule, and muscle, and carried beneath the lower blade of the advancement forceps nearly to the corneal margin. The needle is here passed through the tough circum-corneal fibrous tissue and brought out at G¹. The two ends of the thread are then temporarily tied loosely, with a single hitch, at H. The first suture is then similarly completed. The anterior part of the muscle and capsule and conjunctiva are then removed by cutting them through with scissors behind where they are grasped by the advancement forceps. The gap is then closed by tightening and securely tying each suture at HH, so that the eyeball is rotated in its correct position, and the anterior end of the muscle is brought nearly up to the corneal margin at GG¹.

In operating under cocaine, before the knots are tied at HH, an assistant holds the globe in the primary position with forceps; while the patient is told to try and look away from the operated muscle. This relaxes the muscle, while it is being drawn forward by the sutures. The sutures are then temporarily secured at HH by the first hitch of the 'surgeon's knot.' The assistant then releases the globe. The fine adjustment is done by tightening or loosening the hitches at HH, the result being checked by the mirror test or by the reflection of a candle flame on the corneal. The surgeon's knots at HH are then completed.

The longitudinal position on the muscle of the knotted loops A B C, A' B' C¹, varies approximately according to the degree of rotation required.

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